

# MODERN MachineShop

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# MODERN MachineShop

CINCINNATI, OHIO

JANUARY, 1930

VOL. 2, No. 8

## Machining Parts for Wright "Whirlwind" Engines. I.

By PHILIP WINTER

ALL three models of the Wright "Whirlwind" Aviation Engine are of the fixed radial, air-cooled type, operating on the conventional four-stroke cycle. All three models employ the same type of cylinder, which has a bore of 5 inches and a stroke of 5.5 inches. The engine parts are interchangeable to a high degree, and the differences in engine construction are relatively minor.

The crankcase used in all three models of this engine is composed of five aluminum alloy castings which

*This is the first of a series of five articles in which the equipment and methods used in the production of parts for Wright "Whirlwind" airplane engines will be discussed. This article deals with the machining of the crankcase.*

are bolted together through substantial flanges. Of these five sections, the most interesting, from a production standpoint, are the main and rear sections. The main section carries the cylinders, supports the camshaft rear main bearing, cam follower guides and cam follower plunger guides, and houses the

cam, cam followers and cam follower plungers.

The first operation on the main section of the case is that of boring and facing the rear end to provide a fit for the super-charger section, and

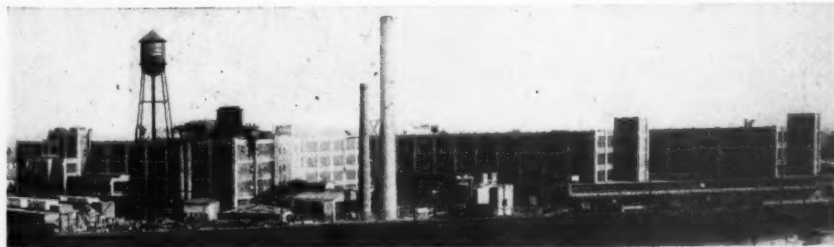


Fig. 1—Main building at the plant of the Wright Aeronautical Corporation, Paterson, N. J. The final motor assembly and foundry occupy separate buildings.

boring and reaming the support for the main bearing. This operation is performed in a Bullard boring mill, as shown in Fig. 2. The piece rests, front end down, in a fixture in which it is held by three screws and three clamps, as shown. The boring and reaming operations are performed with tools that are held in the turret, while a side tool faces the rear end of the case.

The faces of the cylinder pads on the crankcase are finished in a double-spindle "Rigidmil," as shown in Fig. 3. Each pad is roughed and finished in one operation, the roughing cutter removing all but .020 inch, which is left for the finishing cutter. The piece locates by the main bearing support, and is clamped to an

indexing fixture of the usual type. The face of the pad is held to limits of  $\pm .005$  inch from the center of the case.

The holes for the studs by which the main section of the crankcase is assembled to the diffuser and rear sections are drilled with the aid of a jig and the multiple drill shown in Fig. 4. Twenty-seven  $\frac{1}{8}$ -in. holes are drilled for  $\frac{3}{8}$ -in. studs at one operation. The jig is in two parts; a base with a shoulder over which the front end of the case fits, and a ring which contains the bushings for the drills. The piece is located by the oil strainer chamber, which is contacted with a vertical section on the jig, as shown.

The cylinder pads are bored singly, using the drill press shown in Fig. 5 and a tool with two blades. The crankcase is locked in an indexing jig

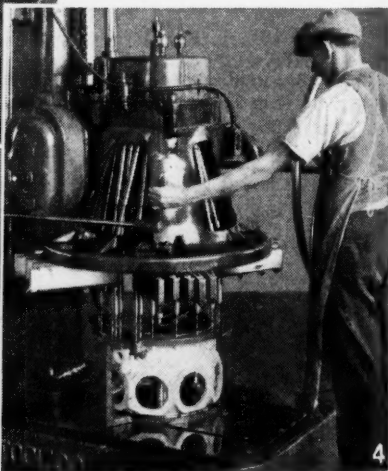
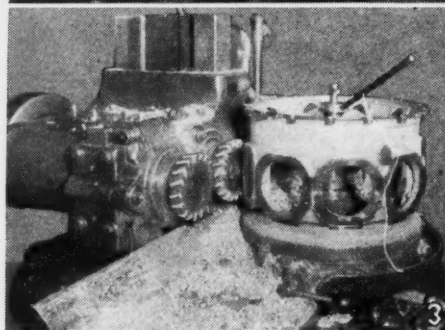
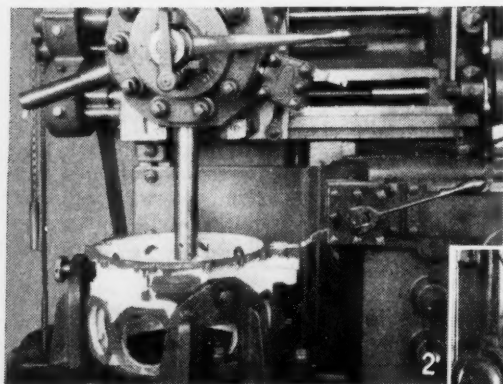


Fig. 2—Boring and facing rear end of main crankcase section. Fig. 3—The cylinder pads are roughed and finished in one operation in the Rigidmil. Fig. 4—Drilling holes for the studs used in assembling the crankcase sections.

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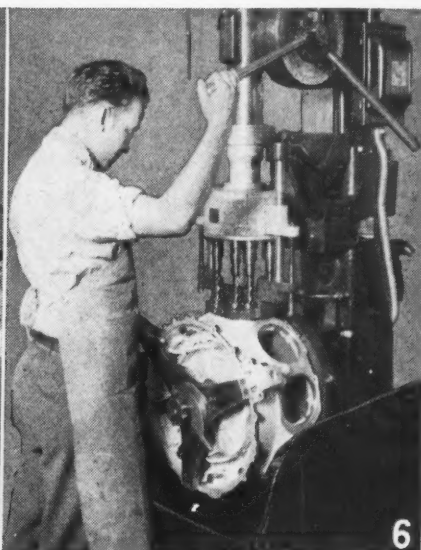
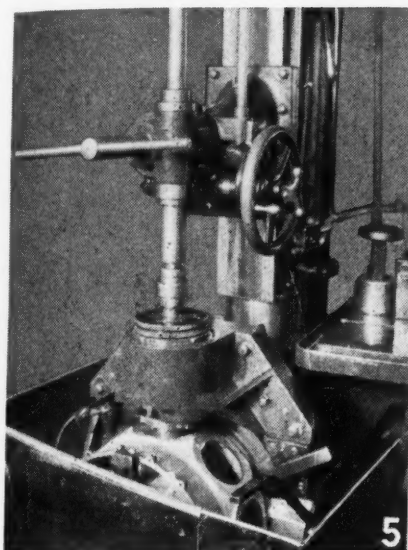


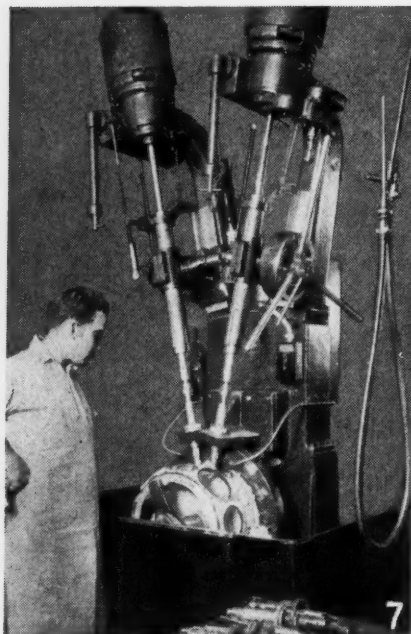
Fig. 5—Boring the cylinder pads in the crankcases. Fig. 6—Drilling eight 5/16-in. holes to be tapped for the cylinder hold-down studs.

which carries a bushing for the tool. The periphery of the tool does not present a continuous surface to the interior of the bushing; instead, six strips of steel are set into the body at even intervals, these strips forming the bearing surface. The body is smaller than the diameter through the strips in order to provide clearance. This type of construction is calculated to provide means for keeping the tool in perfect alignment while at the same time providing for freer action by the reduction of the bearing surface. The two blades, which project from the bottom of the tool, are set in on tapered surfaces so that they can be expanded or contracted by means of the two collars at the top of the tool. The lower collar engages the ends of the blades; the upper collar acts as a lock for the lower one. The hole is held to a limit of .010 inch.

The stud holes in the cylinder pads

are drilled with the equipment shown in Fig. 6. The case is clamped to an indexing jig and the eight  $\frac{5}{16}$ -in. holes for the studs are drilled through a jig-plate which is attached to the multiple head. In lowering the head at the beginning of the operation, the jig-plate strikes first, locating by a disc which fits into the hole in the cylinder pad. As the operator continues to pull the spindle down, the drills pass through the bushings and the operation proceeds. As the head is raised, the drills are withdrawn first, then the jig-plate follows. To aid in locating the jig properly, an arm which is clamped to the machine column holds a shaft which extends downward through bearings in a wing of the head and in the jig-plate. The maximum distance between the head and jig-plate is regulated by the two long screws which lift the jig as the head is raised.

Tappet guide holes in the crank-



case are drilled, reamed, counter-bored and tapped with the two-spindle drill shown in Fig. 7. Here again the case is clamped in an indexing fixture. As the holes are machined at an angle with each other, a special machine is used, having two heads with the spindles forming an angle, as shown. The spindles are driven by separate motors, although connected by a universal joint so that they are controlled by a single hand

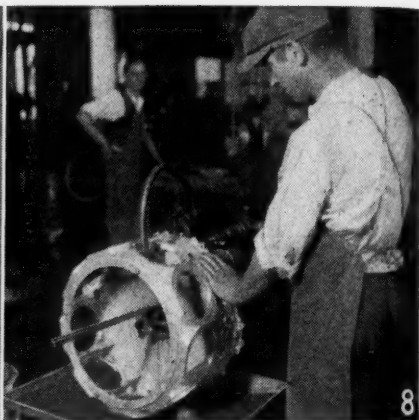


Fig. 7—Tappet guide holes are drilled, reamed, counterbored and tapped with this equipment. Fig. 8—Broaching a keyway for the main bearing.

lever. A single push button controls the power. After drilling, the holes are reamed and counterbored by using the Eclipse two-diameter tools shown in use in the illustration. The diameters of the holes are held to within .001 inch of drawing size, and are checked with plug gages.

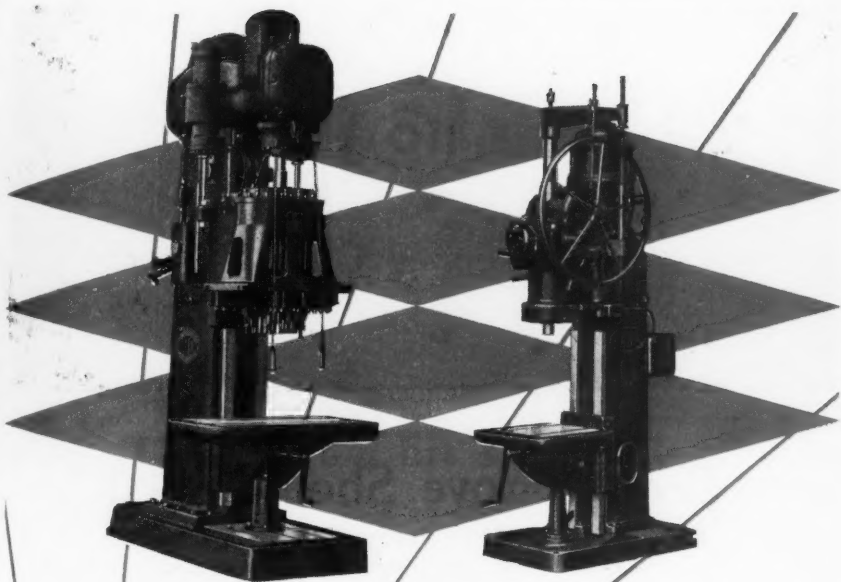
The main bearing is anchored in the front end of the main crankcase section by a key, for which a keyway is cut with the equipment shown in Fig. 8. The machine is a horizontal broaching machine, and the broach is cutting a key way  $.313 \pm .001$  inch wide. Kerosene is used to aid in producing a smooth, accurate finish.

### Danly Wall Spring Chart

The Danly Machine Specialties, Inc., 2122 South 52nd Avenue, Chicago, Ill., has published a revised edition of the Danly Spring Chart for wall use. The chart embraces the complete Danly line of flat-round and square springs, including 83 sizes of the flat-round type and 35 sizes of the square springs. While originally intended for pressure-pad, stripper-plate, and knock-out purposes, these springs are finding wide ap-

plication for automatic machinery and other equipment of all kinds.

The tables are easily read, giving complete data as to size of hole in which spring will work readily, inside diameter of spring, diameter of shaft or stripper bolt to be used, size of wire, loading, maximum compression to close, and so on. In short, the chart includes complete spring information for the designer or die builder, together with prices. Copies may be obtained by addressing the firm as above.



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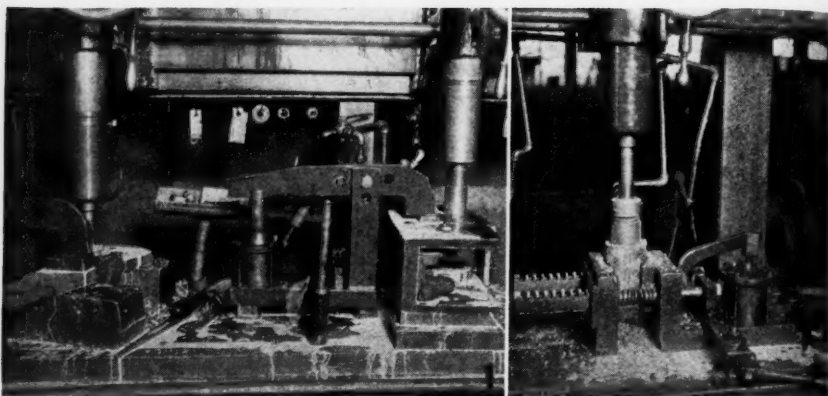


Fig. 1—Air-operated clamps make it possible to keep two spindles busy. Fig. 2—Air operates this vise also, and saves both time and energy.

## Beech Grove Shop Kinks

By AUGUST JACOB

THE comparatively high efficiency of the Big Four Shops at Beech Grove, Indiana, can be credited largely to the use of special tools wherever such tools will increase production or eliminate hand work. Included among these tools are several air-operated chucks and clamps, one of which is shown in Fig. 1. This clamp is employed to hold a jig in place, the main advantage being that the jig can be clamped or unclamped instantly by the simple movement of a lever. As shown in the illustration, the clamp proper is operated by a vertical piston rod, to which it is hinged, and which operates in a small cylinder. As the machine is equipped with two spindles and two

jigs, the use of the air-operated clamp makes it possible for the operator to keep the machine busy without unusual effort.

Another example of the uses to which air has been put in this plant is shown in Fig. 2, where a small air cylinder is shown attached to a vise in such a manner that the piston operates a vise-jaw. The piston is connected to the jaw by means of

a lever which is hinged to the stationary jaw. The lower part of the lever serves as a cam, and as the piston is forced downward by the air, the cam moves a bar which is attached to the moveable jaw and forces the moveable jaw against the work, as shown. By using different sets of jaws, this

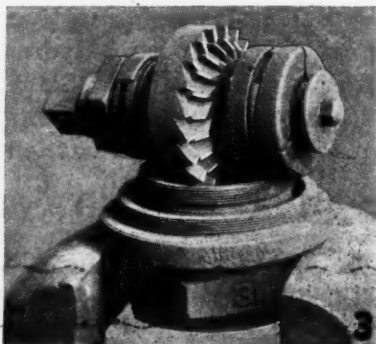
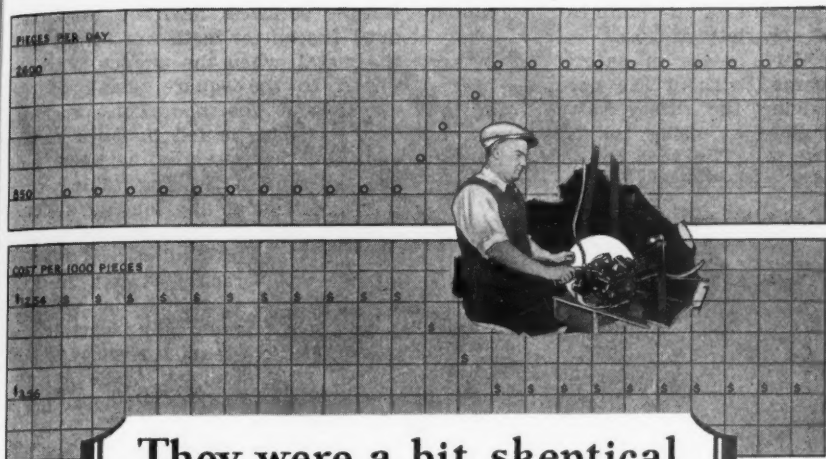


Fig. 3—Safety valve seats are reamed with this tool while the valves are on the engines.



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No. 31 wire gauge holes were being gang drilled through small brass lock-cylinders. For days, we checked the performance of different drills on this job—recording—analyzing—computing. Then we laid the following facts before the production officials of the company:

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| Cost of Drill per Hole . . . .   | \$0.000017       | \$0.0003                     |
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vise with its air-clamp can be adapted to a variety of jobs.

Valve seats in safety valves are reamed without the necessity of removing the safety valves from the engines by using the tool shown in Fig. 3. The tool consists primarily of a cutter with two rows of blades,

is now screwed down on the arbor until the cutter-teeth are forced into the metal, when the wrench is transferred to the square shank of the cutter and the operation proceeds. The tool can be fed in when necessary by turning the hexagon nut, the ball thrust bearing taking care of any binding action.

Another handy tool of similar design is the reamer shown in Fig. 4, which is used to ream the seat in the steam turret, or "fountain." The cutter-shank revolves in a

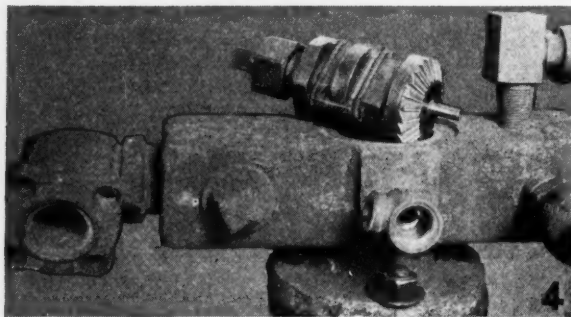
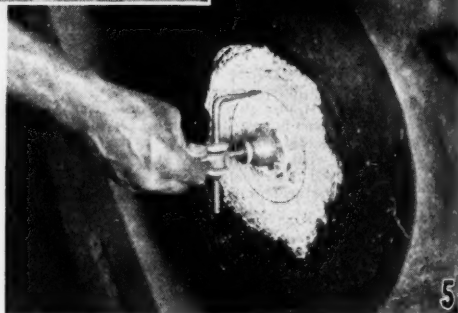


Fig. 4—Tool for reaming seats in steam turrets. Fig. 5—Ball-centering scriber for use in tramming for shoes and wedges.

one of which faces the flat top surface while the other reams the angular surface of the seat. This cutter is mounted on an arbor which is tapered and threaded at the lower end to take a knurled split nut, the nut being held in place by a retaining spring. The upper end of the arbor is threaded to fit a large hexagon nut which is held to the shank of the cutter by means of a ball race. The cutter-shank has been squared to take a wrench.

To use the tool, the split nut is held by hand and the arbor is revolved until the nut will just slide into the opening in the safety valve. Then it is pushed down far enough so that the cutter can seat, and the arbor is again turned, expanding the nut against the interior wall of the valve opening and thus anchoring the tool in position. The hexagon nut



body in which three taper grooves are cut, and which is threaded for a large hexagon nut. In the three grooves are three sections which are threaded 12 P. to fit the threads in the turret, these sections being held in place by springs, as shown. The tool is located for operating by holding it in position in the hole in the turret, then screwing down the large nut and thus forcing the threaded sections along on the taper until they have expanded to fit the hole. An expansion of  $\frac{5}{16}$ -inch is provided for, on account of the variation in the sizes of the





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holes. When the tool is locked in position, the reamer is revolved by applying a wrench to the square on the end of the shank.

in the end of an axle is so deep that it is impossible to inscribe a true circle with the ordinary divider. As can be seen by reference to the illustration, one leg of this



Fig. 6—Upsetting jaws of a binder to fit locomotive frame.

A very simple but useful tool is illustrated in Fig. 5. This is an adjustable ball-centering device, which is used to lay out circles on wheels to tram for shoes and wedges. It often happens that the center hole

tool has a large ball point which will always locate in the true center. The leg which carries the scriber is locked in position by a split bushing and lock nut, thus providing for quick adjustment.

The mechanics shown in Fig. 6 are upsetting the jaws of a binder to make them conform to the dimensions of the jaws on the frame of a locomotive. The binder is clamped in position by means of a large screw, as shown, then hydraulic pressure is applied to the end of the binder, forcing the jaws together. As the operation is slow, it is possible for one mechanic to hold a caliper in position

(Continued on page 50)

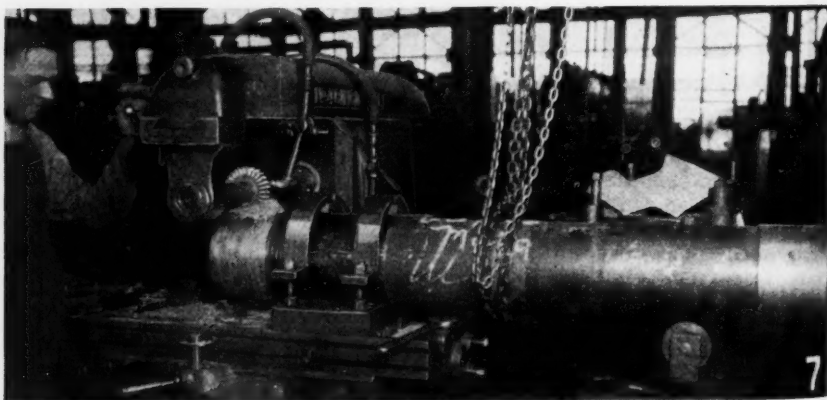
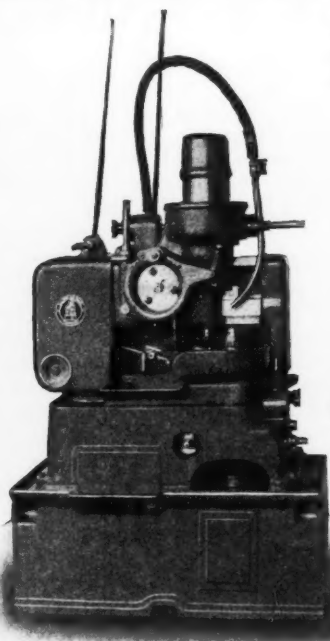


Fig. 7—Milling keyways in driving wheel axles.



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# Non-Ferrous Metals and Alloys, I

By GEORGE M. ENOS,  
Assistant Professor of Metallurgy, University of Cincinnati.

*This is the first of a series of articles dealing with the nature and properties of the common non-ferrous metals and their alloys. In a previous series of articles dealing with "The Nature and Properties of Iron and Steel," the author discussed many fundamental principles of metallurgy, therefore these principles will be mentioned only incidentally in the present series.*

**T**HE term "non-ferrous" metal or alloy refers to any metal or alloy whose properties are not dependent upon the presence of iron. Hence all the pure metals except iron are "non-ferrous" and all the alloys except the various kinds of cast irons, steels, and wrought iron are non-ferrous alloys. In the present article only the pure, or commercially pure, non-ferrous metals will be discussed.

Few metals are used commercially that are even approximately 100 per cent pure. Copper, nickel, chromium, tin and zinc when plated, whether electrolytically or by a dip process, are usually pure. Copper for electrical purposes is quite pure. Lead and zinc, as used for many purposes, are nearly 100 per cent pure metal, and while aluminum can also be produced practically 100 per cent pure, most so-called "aluminum" contains 1 per cent or more of impurities.

Below is given a list of the common non-ferrous metals, roughly classified as to their importance.

| NON-FERROUS<br>BASE METALS |                   | PRECIOUS<br>METALS |
|----------------------------|-------------------|--------------------|
| Most<br>Important          | Less<br>Important |                    |
| Copper                     | Manganese         | Gold               |
| Aluminum                   | Tungsten          | Silver             |
| Lead                       | Vanadium          | Platinum           |
| Zinc                       | Molybdenum        |                    |
| Nickel                     | Cobalt            |                    |
| Chromium                   | Mercury           |                    |
| Tin                        | Arsenic           |                    |
|                            | Antimony          |                    |
|                            | Bismuth           |                    |
|                            | Cadmium           |                    |
|                            | Magnesium         |                    |

The foregoing listing is not intended to rank the metals according to their importance measured in terms of tonnage produced, or in terms of the monetary value of the total tonnage. It is intended to roughly group the metal produced in commercial amounts in order to facilitate further discussion.

Concerning the precious metals and their alloys little need be said here. Their principal uses are in the field of jewelry, ornamentation and the like, and for gold and silver, in coinage. Fabrication of these metals and their alloys is a highly specialized craft or art.

Of the metals listed as of lesser importance, the idea of importance as here expressed is merely relative. for the use of tungsten, manganese, vanadium, and molybdenum in alloy steels, as well as chromium and nickel, is of great importance. As non-ferrous metals, independent of their use in ferrous alloys, they are relatively unimportant. It cannot be said that the importance attached to a metal is permanent, for new uses are constantly being discovered for metals which hitherto have been considered of importance only for some special purpose.

In a treatise not intended to be comprehensive, only a few of the more important of the non-ferrous metals can be discussed. Accordingly, this and subsequent articles will be confined to a discussion of copper, aluminum, lead, zinc, nickel, chromium and tin and their principal alloys.

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### The Occurrence and Recovery of Metals

Very few metals are found in the earth's crust as such. Copper, lead, zinc, and nickel occur mainly as sulphides; that is, each metal occurs associated with sulphur in more or less complex form. Tin occurs associated with oxygen as a simple compound, tin oxide. Aluminum occurs in complex minerals or rocks, such as clay, but as yet it is not possible to recover aluminum commercially from these materials. The common ore of aluminum is bauxite, a compound containing aluminum, oxygen and water. Chromium occurs in several forms, one of the most common being chromite, a mineral containing iron, chromium and oxygen. To obtain the metal it is necessary to separate it from the other elements, such as sulphur or oxygen, with which it is associated in the mineral form.

Certain mechanical concentration processes precede the extraction of the metal, since it is very rarely that the concentration of the metal in its mineral and associated rocks is sufficiently high to warrant a direct extraction process. The ore containing the metal sought is usually crushed and ground to a fine state of subdivision. Difference in specific gravity between the mineral sought and the valueless minerals makes it possible to separate them when the crushed ore is mixed or suspended in water, appropriate mechanical devices being employed. Some other property of the mineral, such as its color or susceptibility to wetting by oil, may be employed in securing a concentrate of the oxide or sulphide of the metal desired.

Wet chemical methods may be employed to extract a metal from its ore; for example, certain copper ores may be dissolved in dilute sulphuric

acid. The solution may then be electrolyzed, and the copper plated out by depositing on copper sheets. In the more common general method the concentrate, that is, the valuable constituents in the ore previously separated out by mechanical or other means, are fused with a flux so as to form a slag with the impurities still present. The slag will float on top of the molten material.

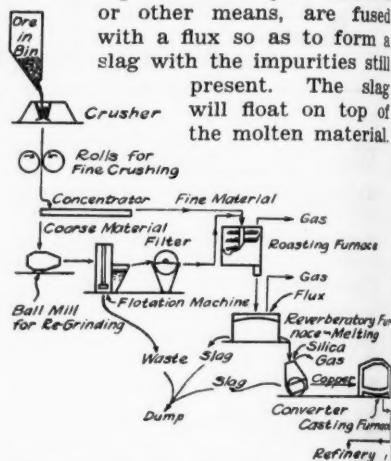


Fig. 1.—Simplified flow sheet showing course of materials through the plant in a smelter producing copper from sulphite ores of copper.

The metallic material may be the metal desired, or it may be an intermediate product which needs further refining. The slag can be tapped away from the molten metal. When sulphides are to be treated, all or a portion of the sulphur may be burned off prior to the fusion. The fusion may result in securing metal desired in a molten state, as for lead, or an intermediate product may be obtained, such as matte, in the case of copper. A copper matte is a fused alloy of copper, iron and sulphur. The matte must be further treated, usually being oxidized at a high heat in order to obtain the copper. The operation is carried out in a converter, similar to the Bessemer converter used in making steel. The sulphur



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is burned off, the iron unites with oxygen and the iron oxide so formed unites with silica (sand) which is charged into the converter, and forms a slag. The copper is left as such and, after casting into suitable form, is electrolyzed. The impure copper is made anode in a bath of acidified copper sulphate, and is deposited in pure form on copper sheets used as cathodes. Peculiarities of the extraction of each metal will be noted later.

### Copper

In one location—northern Michigan—copper is found in nature in the free state, and the copper produced by melting the ore and separating the metal and slag is known as Lake copper. This copper is of a high degree of purity. Otherwise copper is produced from oxide or sulphide ores by a smelting process, the impure copper so obtained being refined electrolytically. Copper so obtained is sometimes known as "electrolytic" copper.

Copper is at present the most important non-ferrous metal in industrial use, although its supremacy is being challenged by aluminum. In the pure state it is used principally in electrical work. The metal is too soft and the tensile strength is too low to make it adaptable for much use in the general field. As is well known, however, copper is an exceedingly good conductor of electricity. The fabrication of copper is usually carried out along lines necessary for the production of parts for electrical equipment. The rolling of copper into sheets and drawing into wire are mill operations. Sheet copper or copper strips can, of course, be readily handled in drawing or stamping operations. There is usually little need for other machine shop operations. Copper alloys readily with magnesium, aluminum, manganese, zinc, tin, cad-

mium, cobalt, nickel, mercury and slightly with iron and with some other metals. So important are the brasses and bronzes—alloys where copper is the principal alloying element—that they will be discussed in a separate article.

### Aluminum

Aluminum occurs in many minerals, but from only one, bauxite (the oxide), is its extraction commercially feasible at the present time. The bauxite is purified by treatment with a water solution of caustic soda, under heat and pressure. From this treatment the aluminum emerges as the precipitated hydroxide which is filtered out, and is converted by heating back to the oxide form, having left much of the impurities in solution. The purified aluminum oxide is now relatively free from impurities and is a white powder, ready to be reduced to the metallic form. At this point it is charged into an electric furnace which contains a molten flux composed of calcium, aluminum and sodium. The aluminum oxide dissolves in the molten material, and the passage of electric current causes the aluminum to precipitate on the carbon bottom of the furnace (the cathode). The anodes are carbon rods and are suspended in the molten mass. The molten aluminum is periodically tapped from the bottom of the furnace. At this point it is electrolyzed in a bath of fused fluorides of aluminum, sodium and calcium. Aluminum has such a high affinity for oxygen at high temperatures that ordinary smelting methods cannot be employed. Figure 2 shows a sketch of an electrolyzing furnace for the production of aluminum.

The ordinary commercial aluminum is usually 98 to 99 per cent aluminum, with iron and silicon as the principal impurities. The term "aluminum" is loosely used to denote

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### FEATURES

Dividing Head can be swivelled or set in a horizontal position.

Headstock swivels to right or left, 30 degrees.

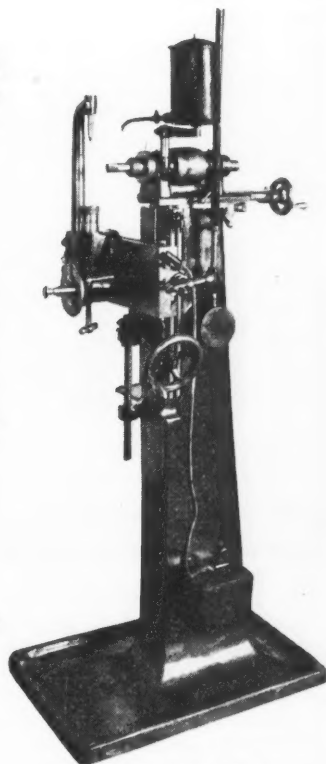
Collets interchangeable on dividing head or headstock.

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either aluminum or light aluminum alloys. According to Aitchison and Barclay in "Engineering Non-Ferrous Metals and Alloys," commercially pure aluminum is never used for castings. Hence all so-called "aluminum castings" are really composed of some light alloy of aluminum, as will be described later. The "pure" metal is used in the form of sheets,

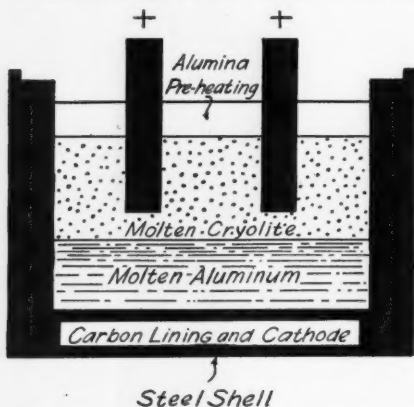


Fig. 2—Diagrammatic sketch of an electric furnace used in producing aluminum.

tubes, wires, rods, and the like. Aluminum can be forged hot if desired, and can be cold worked or drawn readily. A high degree of purity can be obtained and 99.9 per cent aluminum can be secured if desired. The light aluminum alloys will also be discussed in a separate article.

### Lead

Lead is obtained mainly from galena, lead sulphide, a compound of lead and sulphur. After concentration, the galena is heated, the sulphur being burned off and leaving the oxide of lead. Smelting in a blast furnace follows, and an impure lead obtained. The method of purification depends upon the impurities present; usually some of them are eliminated by heating the lead in the presence

of air. Silver is often an important by-product of the plant, as silver is often found in lead ores.

Lead in the pure state is limited as to use. Alloyed with tin it forms solder; alloyed with antimony, with or without small amounts of other metals, it forms white metal alloys. Various bearing metals contain lead as an important ingredient. Around machine shops, lead is of interest primarily in the alloy form, as solder or bearing metal. Because lead and its alloys are so soft, care must be taken in grinding operations not to "lead" up the grinding wheels. Obviously it cuts very easily.

### Zinc

The most important ore of zinc is the sulphide. After concentrating and roasting to the oxide form, the zinc concentrate is mixed with finely divided coal and heated in retorts. The zinc is reduced and leaves the retort as a vapor which is then condensed to liquid zinc. Zinc can also be recovered from its ores by leaching; that is by dissolving the roasted product in dilute sulphuric acid, followed by electrolyzing the solution, the zinc being plated out on aluminum cathodes.

Zinc is used very largely in the manufacture of paint and for other industrial purposes, but in the metal-working field zinc, as such, is chiefly of interest as a protective coating on steel. There are several processes used for applying the zinc, the most common of which is the galvanizing process. In this process, steel cleaned by pickling, is dipped into molten zinc which freezes onto the steel. It is unnecessary to enlarge on the use of galvanized material. As an alloying metal, zinc is widely used in the manufacture of brasses, with aluminum in certain light aluminum alloys and in other special alloys.

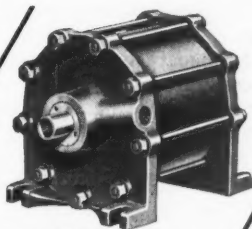
Zinc can be rolled, hammered or

# "LOGAN"

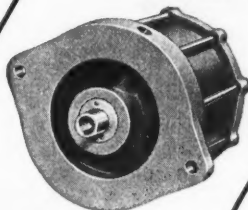
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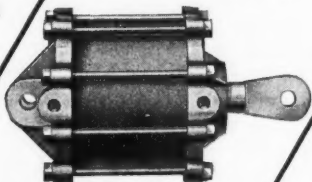
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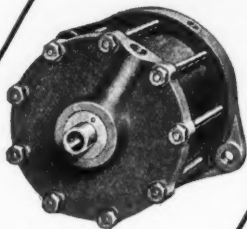
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pressed at temperatures between 100 and 150°C.; that is, it is quite ductile in that temperature range. However, if the temperature be raised to 200°C. the zinc becomes so brittle that it can be pulverized.

### Nickel

Nickel occurs in several minerals of the sulphide type. Very few nickel deposits are found in the United States. It is difficult to describe in a few words the methods employed for recovering nickel. All commercial processes start with a copper-nickel-iron sulphide fused product known as nickel matte, which is obtained by methods similar to those employed for obtaining copper. Some of the deposits contain copper, nickel and small amounts of other metals in such amounts that the ore can be smelted direct to Monel Metal.

Nickel is a ductile metal and quite tenacious. It can be rolled and drawn. When used as pure nickel one of the principal uses is in plating on iron or steel for purposes of beauty and protection, as it is much more resistant to corrosion than iron. Nickel readily alloys with copper and many other metals. Coin metal, nickel silver, German silver, Monel Metal, and other non-ferrous alloys are quite easily handled in machining operations.

### Chromium

Like nickel, chromium is found only in small amounts in the United States. The principal ore is a chrome iron ore. The chrome iron ore is heated with sodium carbonate, but without melting. The mass is then treated with hot water, and the chromium compound dissolved, leaving the iron, as iron oxide, undissolved. The clear, filtered solution containing chromium is treated with sulphuric acid, and a separation of sodium sulphate from the sodium dichromate accomplished. The sod-

ium dichromate is fused with sulphur, which converts the material into sodium sulphate and chromium oxide. The sodium sulphate is dissolved by water, and the chromium oxide dried. It is then reduced to metallic chromium by charcoal in a crucible, or in an electric furnace. It may also be reduced by aluminum (Thermite Process).

Chromium, as such, is mostly used as a plating material, and when properly applied is very hard and resistant to scratching. It does not corrode or tarnish under ordinary conditions. Chromium plating when used on gauges, band saws, files, mandrels, and some types of dies, has been found to increase the life of the article. The development of chromium plating dates back only a few years. Not all attempts to use chromium plate on tools as mentioned above have proved successful, due to the fact that much depends on proper plating. In general, chromium plated surfaces resist wear and abrasion, but do not stand shock and impact as well as might be desired.

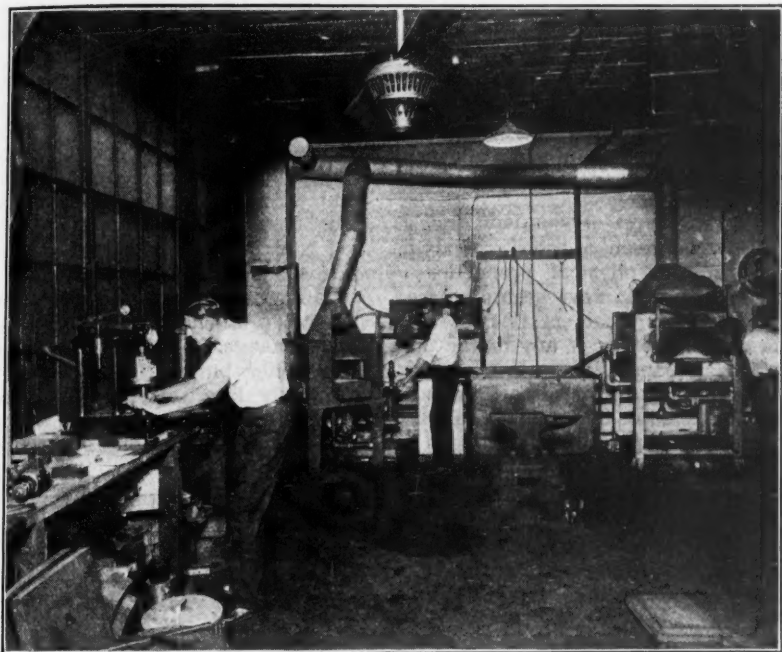
Chromium, in addition to being an alloying element in ferrous metals, also alloys with nickel, forming a useful series of alloys. These alloys show high resistance to heat and electricity, high tensile strength at high temperatures, and high corrosion resistance.

### Tin

Tin is not found in appreciable amounts in the United States, the only ore of importance being the oxide. After concentration, tin can be reduced by a comparatively simple smelting process. Since tin oxide has a tendency to act as an acid anhydride, certain precautions must be taken to insure that as small an amount of the oxide as possible goes to the slag. Tin has low tenacity and is rather soft. It is highly ductile.



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QUOTATION follows from a letter received from the Curn Trolley Track Mfg. Co.:

"We have increased largely our die and tool department, so that we now have a man working on this class of material all the time. In the hardening operations as well as in the machining of the raw material, it becomes necessary to know just how

hard these various items are. The Hardness Tester is therefore in constant use, testing finished dies and punches, as well as material that is not finished. It has become an integral part of our various operations along these lines, so we would be very much at sea without it.

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New York

tile, and can be readily rolled to thin sheets at 100°C., but at 200°C. it is brittle. At very low temperatures it will turn to a gray powder.

The principal use of tin as a metal is in making tin plate, that is, coating of steel or iron with tin by the dip process. From the tin plate is obtained the ever-useful "tin can." As an alloying element, tin is widely used and highly valued in such alloys as bronzes, bearing metals, and solder.

### General Discussion

Below is given a table embodying some of the physical properties of the metals which have been discussed. No particular comment is needed on the machineability of any of the pure metals, because, as previously explained, the pure metals are not usually employed in the ordinary machine shop. Finishing operations, such as

polishing and buffing, yield a surface of pleasing appearance on any of the metals discussed, except lead. Lead flows so easily on the surface that polishing or buffing is rarely employed. Further, lead soon corrodes in ordinary atmospheres, forming a very thin surface coating or film, gray in appearance. The other metals mentioned also tarnish to a greater or less extent. Copper will in time, if left undisturbed, form a "patina," that is, a coating forms on the surface and the metal loses its bright red color. When aluminum and zinc tarnish, their oxidation products are usually thin enough and near enough the color of the original metal that little change is noticed. Nickel and tin, while but little attacked, will gradually lose their lustre. Chromium is far more resistant to corrosive attack than any of the other metals

**TABLE 1.**  
**Properties of Some of the Common Non-Ferrous Metals**

| Name     | Melting Point in ° C. | Specific Gravity | Color         | Moh's Scale Hardness | Tensile Strength in lbs. per sq. in.                                 |
|----------|-----------------------|------------------|---------------|----------------------|--|
| Copper   | 1083                  | 8.65             | Reddish       | 3.0                  | Rolled, annealed, 30,000 to 40,000<br>Hard drawn 60,000 to 70,000    |
| Aluminum | 658                   | 2.56             | Tin white     | 2.9                  | Cast 11,000 to 16,500<br>Rolled 16,500 to 22,400                     |
| Lead     | 327                   | 11.4             | Blue gray     | 1.5                  | 2600 to 3300   |
| Zinc     | 419.4                 | 7.0              | Bluish white  | 2.5                  | Cast 4,000 to 12,000<br>Rolled 27,000 to 36,000<br>Hard drawn 10,000 |
| Nickel   | 1450                  | 8.5              | White         | 3.5                  | Wire hard drawn 150,000 to 160,000<br>Sheets 76,000 to 92,000        |
| Chromium | 1520                  | 7.0              | Grayish white | 9.0                  | .....  |
| Tin      | 232                   | 7.3              | Silver white  | 1.8                  | Cast 4,000<br>Rolled 53,000<br>Hard drawn 10,000                     |

Data assembled from "Outline of Metallurgical Practice," By Hayward. (D. Van Nostrand Co.)

### "Precision Grinding"

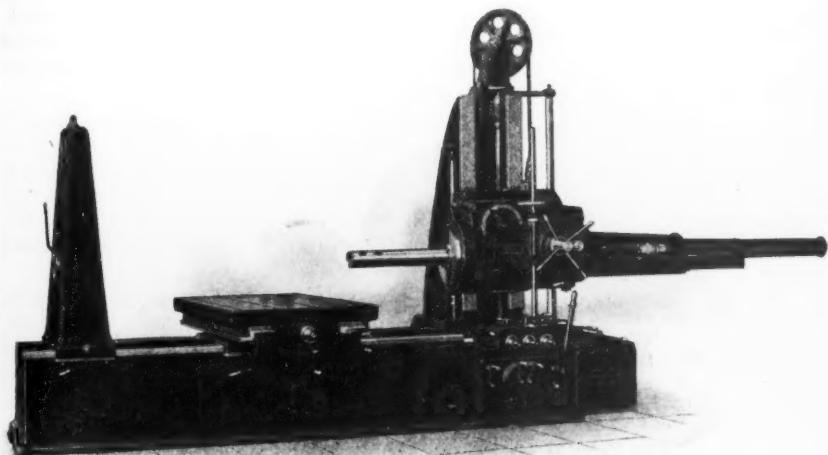
A new booklet featuring precision grinding applications has been issued by Cincinnati Grinders, Incorporated, Cincinnati, Ohio. Approximately 40 grinding machine installations are shown on a wide variety of work. Both center-

type and centerless grinders are illustrated and a brief description of each job is included, together with production data, limits of accuracy maintained, operating features, and other interesting details. A copy of this booklet will be sent free to any mechanical executive.

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# A System of Symbols for the Shop Foreman

By R. H. KASPER

**I**N the shop doing a variety of work, whether for use in the plant or for other plants, it is the duty of the foreman to produce the work as quickly and cheaply as possible. To do this, it is necessary to plan the work so that the various processes

When several large orders are in process at the one time, parts may be overlooked or duplicated, unless some notations are made. The average foreman does keep a notebook, or notes of some kind, but the writer has found that the best place to make the notations is on the drawings. In order to avoid a lot of abbreviated scribbling—which in a short time becomes undecipherable—a system of symbols, as shown, is used. These symbols are so arranged that a completed figure represents completed work insofar as that particular part is concerned.













Though the symbols are practically self-explanatory, a brief explanation may not be amiss. Symbols 1, 2, 3 and 4 apply to parts which may be made more cheaply in a shop better equipped for that particular class of work.

Symbols 5, 6 and 7 apply to parts such as gears, clutches, pulleys, etc., which may be purchased from stock sizes ready for assembling. Symbol 8 applies to parts which may be purchased completely assembled as a unit, ready for attachment to the machine under construction.

Symbols 9, 10, 11 and 12 apply to parts which are fabricated in the shop, and serve to indicate the progress of the work.

The writer uses a yellow crayon pencil on blueprints, as it produces a color contrast which is easily seen and readily erased.

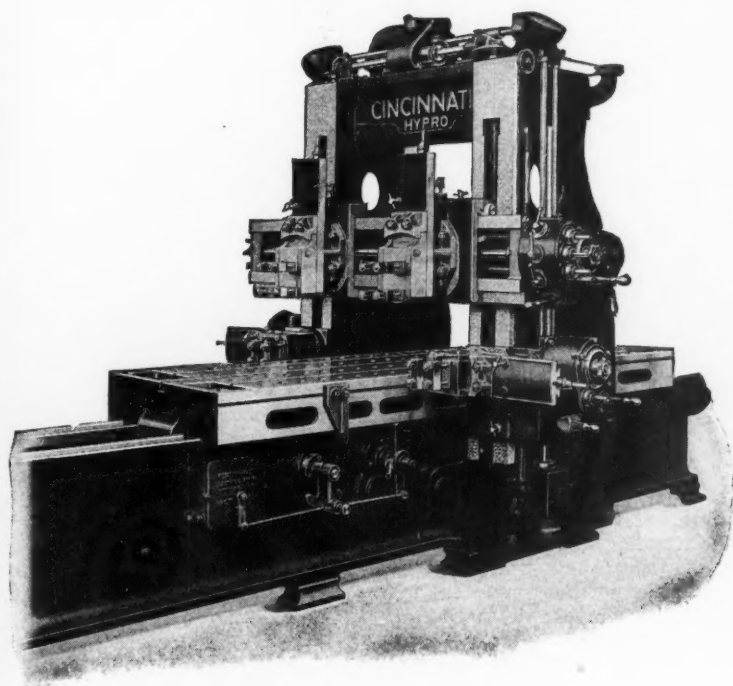
## TABLE OF SYMBOLS

- |   |                                     |
|---|-------------------------------------|
|    | (1) Estimate requested.             |
|    | (2) Estimate received.              |
|    | (3) Contract placed.                |
|    | (4) Contract filled.                |
|    | (5) Parts ordered.                  |
|    | (6) Parts received.                 |
|    | (7) Parts assembled.                |
|   | (8) Unit ordered complete.          |
|  | (9) Material ordered.               |
|  | (10) Material received.             |
|  | (11) Material machined and checked. |
|  | (12) Material assembled.            |

will fit in smoothly and thus avoid delays. It is also necessary to purchase parts or units complete when a saving can be effected, or to make them if they can be made more cheaply.

TH

# CINCINNATI HYPRO-PLANER



Selective Dial Feed, Instantaneous Rail Lift  
Rail Clamp, Rapid Traverse and Forced  
Lubrication are a few of the  
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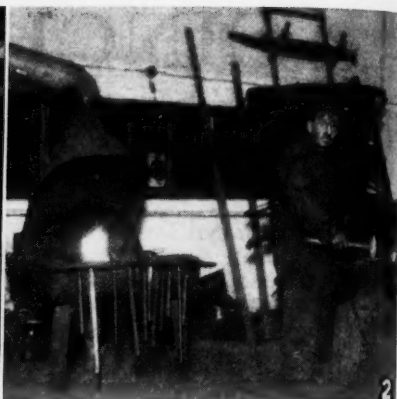


Fig. 1—Corner of a typical welding shop. Fig. 2—The blacksmith's forge should be located in the welding shop.

## Advantages of a Central Welding Shop

By F. J. FITZGERALD  
The Linde Air Products Company

**M**OST factories, mills, and machine shops are today using the oxy-acetylene welding and cutting process somewhere about their works, either for production or for maintenance work. If the process is used for maintenance only, and the amount of work done is small, a portable truck outfit which includes oxygen and acetylene cylinders, regulators, hose, and blowpipes is sufficient. In many plants, however, central welding shops or departments have been established where all work to be welded is

brought. Such a department is shown in Fig. 1.

The benefits to be derived from centralizing welding equipment in this manner are many. The apparatus is kept together, the foremen know where to take work that is to be done, the quality of the work can be better controlled, repair parts and tools can be stored systematically, and—what is perhaps more important—it is possible to keep a definite record of the amount of welding done and of welding costs.

The layout of a



Fig. 3—Small parts are easily repaired by Ox-welding.

Fig. 1

These  
ribbed,

| No. | S     |
|-----|-------|
| 17  | 3 3/4 |
| 27  | 6     |
| 37  | 8     |
| 47  | 10    |
| 57  | 14    |

SHEL

Fig. 3

| No. |  |
|-----|--|
| 1P  |  |
| 2P  |  |
| 3P  |  |
| 4P  |  |
| 5P  |  |

Fig. 1  
Planer  
Jack

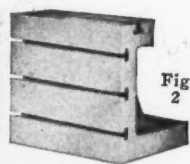
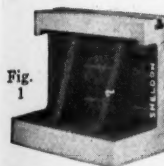
| No. | Ho |
|-----|----|
| 1   | 2  |
| 2   | 3  |
| 3   | 5  |
| 4   | 7  |

|   |   |
|---|---|
| 1 | 2 |
| 2 | 4 |
| 3 | 6 |
| 4 | 8 |

|   |   |
|---|---|
| 1 | 3 |
| 2 | 4 |
| 3 | 6 |
| 4 | 8 |



## Sheldon 90° Angle Plates

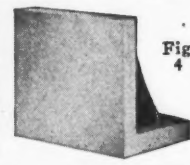
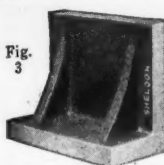


These Plates are made of semi-steel, heavily ribbed, insuring close-grained, rigid castings.

With Second Face and T Slots

| No. | Size Face | Size Top   | Size Base  | T Slots | Wt., Lbs. | Price, Each |
|-----|-----------|------------|------------|---------|-----------|-------------|
| 17  | 3 3/4 x 5 | 1 1/2 x 5  | 2 1/2 x 5  | 4-1/4"  | 5         | \$10.00     |
| 27  | 6 x 7     | 2 1/2 x 7  | 4 1/2 x 7  | 4-1/2"  | 20        | 15.00       |
| 37  | 8 x 9     | 3 x 9      | 6 x 9      | 4-1/2"  | 38        | 20.00       |
| 47  | 10 x 12   | 3 1/2 x 12 | 7 3/4 x 12 | 4-3/4"  | 75        | 30.00       |
| 57  | 14 x 16   | 4 x 16     | 9 x 16     | 4-3/4"  | 170       | 45.00       |

## SHELDON 90° PLAIN ANGLE PLATES



| No. | Size Face | Thickness Face | Size Base  | Wt., Lbs. | Price, Each |
|-----|-----------|----------------|------------|-----------|-------------|
| 1P  | 3 3/4 x 5 | 1/4            | 2 1/2 x 5  | 4         | \$ 8.00     |
| 2P  | 6 x 7     | 3/4            | 4 1/2 x 7  | 15        | 10.00       |
| 3P  | 8 x 9     | 1              | 6 x 9      | 30        | 14.00       |
| 4P  | 10 x 12   | 1 1/4          | 7 3/4 x 12 | 60        | 20.00       |
| 5P  | 14 x 16   | 1 1/2          | 9 x 16     | 145       | 30.00       |

## Sheldon "Set-Up" Jacks



## PLANER JACKS (Fig. 1)

| No. | Height, Contracted | Height, Extended | Diam., Screw | Weight, Lbs. | Price, Each |
|-----|--------------------|------------------|--------------|--------------|-------------|
| 1   | 2 3/4              | 3 3/4            | 3/4          | 1 1/2        | \$1.25      |
| 2   | 3 3/4              | 5 1/4            | 1 1/4        | 3            | 2.10        |
| 3   | 5 1/4              | 7 1/2            | 1 1/4        | 6            | 3.00        |
| 4   | 7 1/2              | 12               | 1 1/2        | 12           | 6.00        |

## VERTICAL JACKS (Fig. 2)

| No. | Height, Contracted | Height, Extended | Diam., Screw | Weight, Lbs. | Price, Each |
|-----|--------------------|------------------|--------------|--------------|-------------|
| 1   | 2 3/4              | 4                | 3/4          | 1 1/2        | \$ .75      |
| 2   | 4                  | 7 1/2            | 5/8          | 2            | 1.10        |
| 3   | 6 3/4              | 12               | 3/4          | 5 1/2        | 1.70        |
| 4   | 8 3/4              | 15               | 1            | 7            | 2.50        |

## BRACING JACKS (Fig. 3)

| No. | Height, Contracted | Height, Extended | Diam., Screw | Weight, Lbs. | Price, Each |
|-----|--------------------|------------------|--------------|--------------|-------------|
| 1   | 3 3/4              | 6                | 5/8          | 1            | \$ .65      |
| 2   | 4 3/4              | 8                | 5/8          | 2            | 1.00        |
| 3   | 6 3/4              | 12               | 3/4          | 3            | 1.50        |
| 4   | 8 3/4              | 16               | 3/4          | 4            | 2.10        |

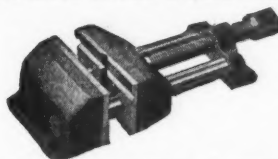
## Sheldon Milling Machine Vises



Furnished Both Plain and With Swivel Base.  
SPECIFICATIONS AND PRICES:

| No. | Width of Jaws | Depth of Jaws | Jaws Open | PLAIN VISE |         | SWIVEL VISE |         |
|-----|---------------|---------------|-----------|------------|---------|-------------|---------|
|     |               |               |           | Wt., lbs.  | Price   | Wt., lbs.   | Price   |
| 3   | 3 1/2"        | 1 3/4"        | 2 1/2"    | 15         | \$16.00 | 25          | \$20.00 |
| 4   | 4 1/2"        | 1 3/4"        | 3 1/2"    | 30         | \$20.00 | 45          | \$24.00 |
| 6   | 6 1/2"        | 2"            | 4 1/2"    | 70         | \$30.00 | 90          | \$40.00 |
| 8   | 8 1/2"        | 2 1/2"        | 7"        | 160        | \$45.00 | 225         | \$60.00 |

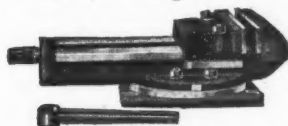
## Sheldon Drill Press Vises



Guide Bars are Hardened and Ground.  
SPECIFICATIONS AND PRICES:

| No. | Width of Jaws | Depth of Jaws over Guide Bars | Full Depth of Jaws | Jaws Open | Wt., lbs. | Price   |
|-----|---------------|-------------------------------|--------------------|-----------|-----------|---------|
| D 4 | 4 1/2"        | 1 3/4"                        | 3"                 | 4"        | 15        | \$12.00 |
| D 6 | 6 1/2"        | 1 3/4"                        | 3 3/4"             | 6"        | 35        | \$18.00 |
| D 9 | 9"            | 2 1/2"                        | 4 1/2"             | 9"        | 70        | \$24.00 |

## Sheldon Shaper Vises



SPECIFICATIONS AND PRICES:

| No. | Size of Jaws    | Vise Opens | Bolt Hole Spacing* | Wt., lbs. | Price    |
|-----|-----------------|------------|--------------------|-----------|----------|
| 1   | 1 1/2" x 2 1/4" | 12 1/4"    | 7 1/4"             | 175       | \$120.00 |
| 2   | 14" x 2 3/4"    | 13 1/2"    | 8 1/2"             | 240       | \$135.00 |

\*Distance between holes can be changed without additional charge.

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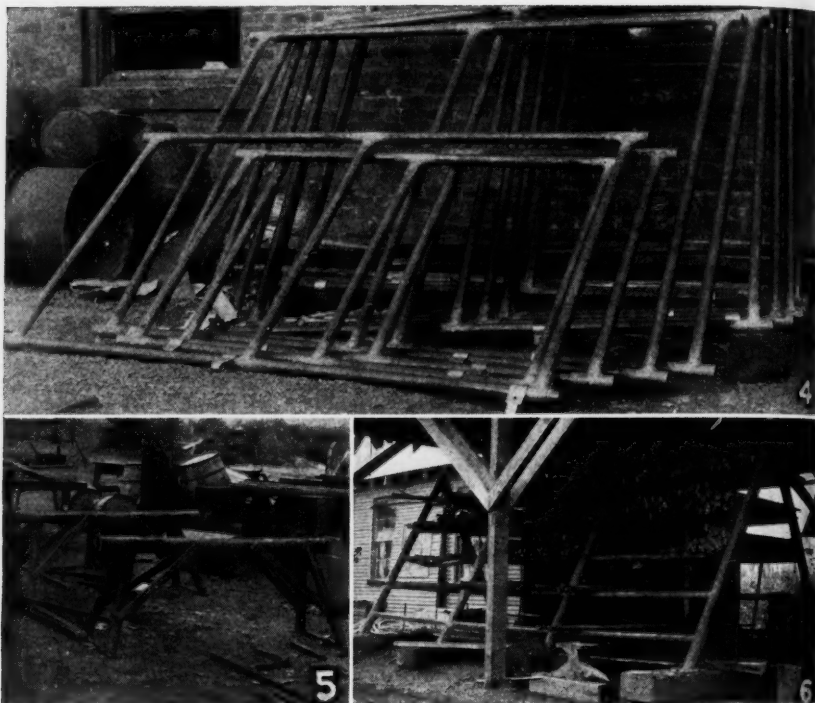


Fig. 4—Welded gate frames. Fig. 5—Iron work horses made of pieces salvaged from the scrap pile and welded together. Fig. 6—A sturdy rack of all-welded construction.

central welding shop is determined to a large extent by local conditions, but there are certain general principles which can usually be followed to advantage. While all of the following equipment is not absolutely essential, such a shop might contain, in addition to the necessary welding equipment, a grinding wheel, drill press, an anvil, a gas or oil-fired preheating furnace, an annealing box, and compressed air lines. There should be one or more substantial welding tables for use in welding small parts, and perhaps a rack or bench containing an ample assortment of smaller machinist's and blacksmith's tools. If the shop employs a blacksmith, his forge and tools should be located in this department. The blacksmith's

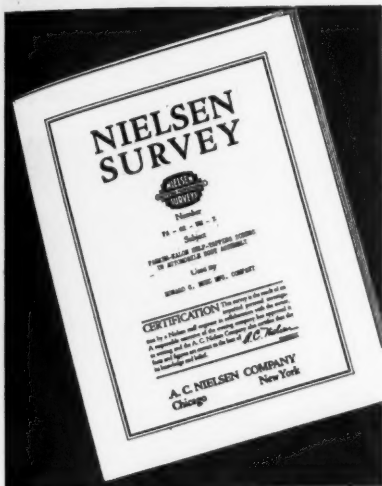
corner in a central welding department is shown in Fig. 2.

Several hundred firebrick or dead-burned building brick should be stored close at hand for use in building temporary preheating furnaces. It is important that the work should be completely enclosed in most cases, and large castings require quite a number of bricks. For the welding of smaller castings, some shop men have expedited the construction of the furnace by using built-up brick units which form complete side-walls. Each unit consists of several bricks set in fire-clay, so spaced that openings are left at the base for draft. When these four side-walls are set to form a square, four draft openings are formed—one at each corner of the furnace

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**W**HETHER you make automobile bodies or corn poppers...if in the assembly of your product you join sheet metal or make fastenings to sheet metal you cannot afford to miss this report.

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PATENTED APR. 2 1910 - NO. 1,092,812 - MAR. 22 1917 - NO. 1,277,014  
AUG. 16 1922 - NO. 1,407,718 - FEB. 10 1925 - NO. 1,548,842 - OTHER PENDING

I want to read the engineers' report of the survey made in the plants of the E. G. Budd Manufacturing Co.

Name and Title \_\_\_\_\_

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The establishment of a central welding shop effects many savings and accomplishes much. Stocks of replacement parts can be reduced to the minimum. Broken parts which formerly were scrapped can be salvaged quickly and economically with the welding torch. Old pipe—which has a habit of accumulating about the shop or yard—can be fabricated into such useful accessories as carpenter's

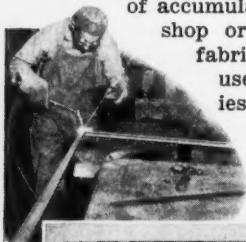


Fig. 7—Welding corner of metal frame.



Fig. 8—Side of guard tack-welded in place.

horses, light trucks, carboy carriers, racks, railings, partitions, plant fences, and the like. A number of gate-frames which have been assembled by the oxy-acetylene process are shown in Fig. 4. Figure 5 shows a pair of iron work horses that have been made of pieces which were salvaged from the scrap pile and welded together. A sturdy rack for steel storage, fabricated by the welding process, is shown in use in Fig. 6.

An example of the general utility of the welding shop is shown in Figs. 7, 8 and 9, where the operation of welding machine guards, together with the finished product, can be seen. These guards were formerly made of heavy wire mesh riveted to frames of angle iron. In addition to the comparatively large initial expense, the rivets and nuts worked

loose, due to the vibration of the machines. The first improvement consisted in tack-welding wire mesh to angle iron frames. Steel welding rod was used for this purpose until it was suggested that the metal might just as well be fused together without using any rod at all. This method produced a good, stiff guard, and saved the cost of punching or drilling holes and assembling the parts together with bolts or rivets. The costs, however, were still too high, and it was finally decided to bronze-weld perforated metal to an angle iron frame. This method pro-

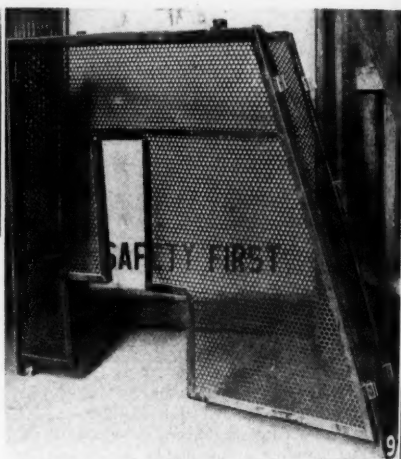


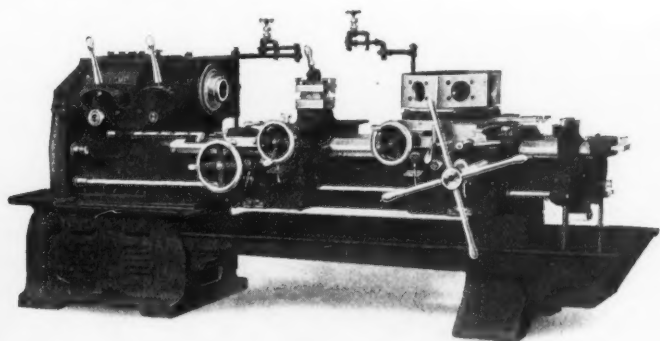
Fig. 9—An all-welded safety guard.

duced an ideal guard, and one which met all requirements.

A bronze welding rod makes a very strong joint with much less heat than is required for steel rod. The use of bronze rod saves oxygen, acetylene, and the welder's time. Furthermore, by using less heat, the warping of either the perforated metal or the frame-work is avoided.

Construction details of the guard shown were studied carefully in or-

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der to economize as much as possible on first cost. For instance, the frame is made up of angles, heel cut, and perforated sheet which is lapped on the inside legs of the angles. In welding the first few guards with bronze, the blowpipe was held inside the guard and the perforated metal was brazed to the inside of the frame. After experimenting, however, it was

tral welding department could be credited with the development of a better piece of equipment and a method of making it, as well as with making a saving of more than 50 per cent of the labor cost.

One of the largest items of expense in the average factory is the replacement of broken gears. A broken tooth usually renders a gear useless, and the replacement of an entire gear is sometimes very expensive. A plant that is equipped with a welding outfit is in a position to repair a

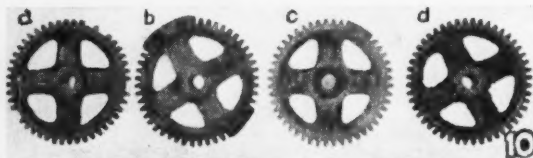
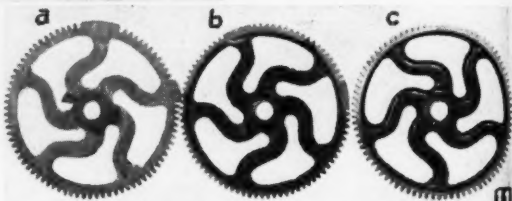


Fig. 10—(a) Gear with broken teeth. (b) Teeth after welding. (c) Gear after weld has been faced flush. (d) Gear with new teeth cut. Fig. 11—Larger gear showing three stages in welding of new teeth. (a) Broken teeth welded. (b) After welds have been faced off. (c) With new teeth cut.



found better to direct the flame from the outside and bronze weld the edge of the angle to the perforated metal. This method makes a stronger job and requires a minimum of heat and bronze.

Figure 7 shows an operator welding  $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{1}{8}$ -in. angles for the frame of a new type of guard. This is the first operation, of course, and is followed by bronze-welding the perforated metal in place. Figure 8 shows the side of a guard at this stage, and Fig. 9 shows the guard after completion.

During the experimental work, two guards of the same size were made by different methods. It took two men  $1\frac{1}{2}$  hours to assemble one guard together with corner plates and bolts, while the other guard was fabricated by a welder and his helper, using the oxy-acetylene process, in 40 minutes. Here was an instance where a cen-

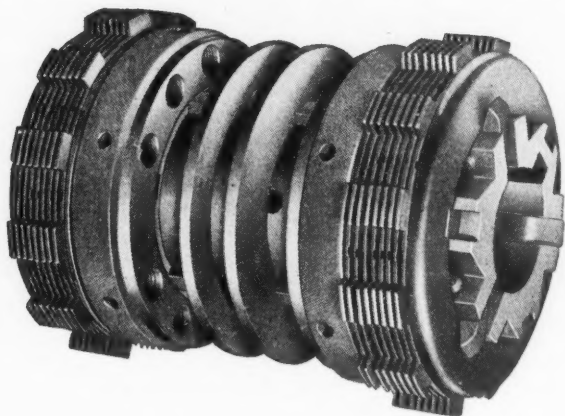
tral welding department, effecting a saving which, very often, amounts to many times the cost of the welding equipment. A tooth is easily built up by simply adding welding rod and then filling to the proper shape. Or, the outline of the tooth is moulded in carbon paste, and then the gear is built up in conformation with the mold and finished. The process is illustrated in Figs. 10 and 11.

In addition to the few applications mentioned, there are a vast number of ways in which repairs on machinery and plant equipment can be made with the aid of the welding torch. In fact, once a central welding shop is established and equipped, the shop executives and maintenance men will soon find themselves acquiring the habit of asking, "Can it be welded?" whenever a machine part fails or a

(Continued on page 50)



# Simplified Engineering



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# How and When To Obtain a Patent

By LEO T. PARKER,  
Attorney-at-Law, Cincinnati, Ohio.

**F**REQUENTLY machine shop owners, managers and employers may conserve considerably and avoid the expenses of filing applications for patents on inventions which later are altered and improved so much that a patent on the original device may be quite worthless.

In other instances, an inventor may lose his rights to obtain a patent by delaying in filing an application until some other inventor has conceived the same idea and proceeded with diligence to obtain a patent. The purpose of this article, therefore, is to explain when and how inventors should obtain patents.

First, it is important to know that a review of previously decided higher court litigations discloses that experimenters of mechanical apparatus may with great certainty protect themselves against loss of their rights to obtain patents, particularly while the inventions are in the course of experimentation. However, the rules established by the various higher courts should be carefully followed during the stages of experimentation on new ideas, otherwise the inventor may lose his rights to obtain a patent.

It is interesting to observe that the courts have held on various occasions that this unfortunate occurrence may result from any of the following reasons:

(1) If another inventor files an application for a patent on the same device, although he may have unfairly acquired knowledge of it from the original inventor.

(2) If another person invents the same **after** the original inventor, but

files his application for a patent before the true inventor.

(3) If the inventor files an application for a patent, but neglects to prosecute his case in the United States Patent Office.

(4) If the original inventor delays an unreasonable period in filing an application for a patent after the invention is completed to a point where it actually will operate.

(5) If the inventor sells, advertises or publicly uses his invention before filing an application for a patent.

(6) If the inventor files an application for a patent before his invention is perfected.

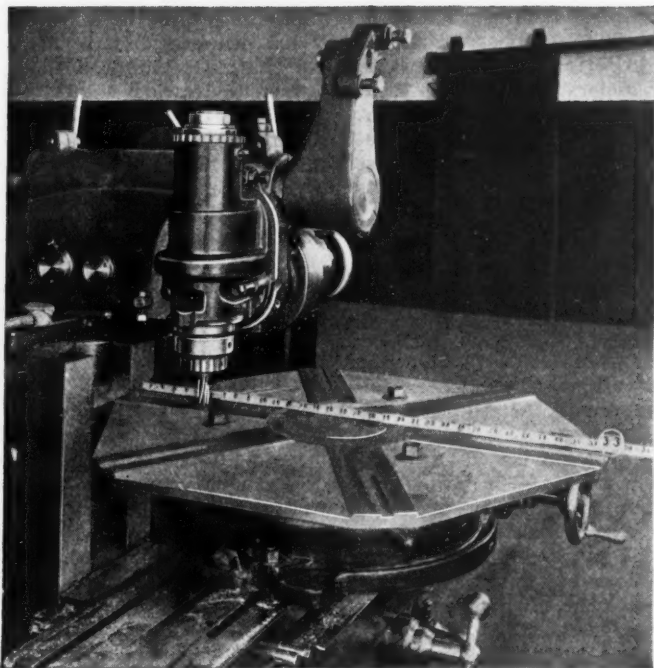
(7) If the inventor fails to establish his priority rights during the experimental stages of the invention.

Many years ago, the Patent Office extended to inventors of unperfected inventions the privilege of filing "caveats," the purpose of which was to enable inventors to prove by Patent Office records the date on which the invention was conceived and the dates on which various improvements were accomplished.

However, since caveats were useful only to prove the character and completeness of the invention on the date the first caveat was filed, subsequent improvements necessitated filing other caveats at a cost of \$15 each. In this manner inventors experienced considerable expense without receiving any protection against infringement, unless at a later date applications for patents were properly filed. Therefore this method of proving priority was abolished.

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a patent to the first inventor who conceived, experimented, perfected and attempted to patent the invention. Therefore, the importance of maintaining usable and legal records of the conception and perfection of an invention is quite apparent. Moreover, it is important for inventors to thoroughly understand that the legal status of an application for a patent is not, as many persons seem to believe, an absolute protection against others filing applications for patents on the same invention.

In other words, the mere fact that a person is first to file an application is not assurance that he will obtain a patent. This is true, contrary to the opinion of the majority of persons, because an inventor may be entitled to a patent although he files an application after another person has secured the patent. The government will revoke a patent issued to a person who is not the real inventor. So, although an inventor possesses a patent he is not positively certain that he shall retain it unless he has records to prove his original conception and perfection of the device. In view of this established law, it is quite apparent that all persons who experiment should maintain records of every experiment.

Many persons are under the impression that a valid patent may be obtained on an invention which is new in the United States. However, the law is well settled that a patent is rightfully issued only to the "original" inventor of the thing patented. In this respect the word "original" has a very broad and comprehensive meaning. In other words, a patent is not valid unless the patentee was the first person to put the invention into practical usage in the whole world. There is one exception, however, in that a simple or experimental use, without publication, in a foreign

country will not bar an American inventor to a patent.

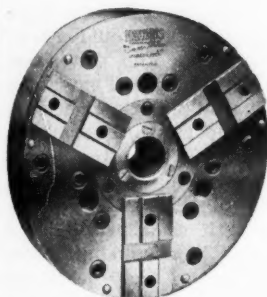
Probably the most common source of litigation and loss of patent rights is failure of an inventor to properly maintain records of experiments. It is not necessary that these records are kept in great detail, as a rough sketch or drawing with a few words describing the construction of the invention, and the results produced, is sufficient. If possible, the signatures of witnesses who read and understand the invention should be obtained so that these persons may later testify. Many inventors simply have the witnesses sign the records, without permitting them to read the description. However, this is not sufficient, as the witnesses must testify regarding the character of the invention.

It is a very good plan that records of experiments should always be made with pen and ink. These records should comprise sketches and written descriptive matter sufficiently complete so that persons familiar with mechanics may comprehend the invention. Each page of the record book should be dated and if possible, the sketches, description, and results of each experiment should be included on the same sheet.

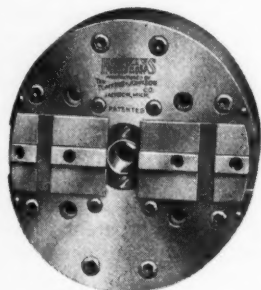
Of course, where two inventors claim the same invention, both may testify regarding the dates of conception and perfection of the inventions, but such testimony is rarely acceptable unless accompanied by dated sketches having written descriptions, with testimony of witnesses to verify the facts.

Frequently negligence in making these first records of new ideas results in the true inventor losing his rights to a patent. The same result may be realized by an inventor who proceeds immediately to file an application for a patent before his invention is practically operative. The

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patent laws require that a valid patent shall issue only for an operative device. Therefore an inventor who obtains a patent for an impractical device has no greater rights than where he possesses no patent.

However, irrespective of the simplicity of an invention, if it is operative it is patentable. For example, a leading higher court (155 U. S. 597) said:

"The apparent simplicity of a new device often leads an inexperienced person to think that it would have occurred to any one familiar with the subject, but the decisive answer is that, with dozens and perhaps hundreds of others laboring in the same field, it has never occurred to any one before."

The obvious lesson is that an inventor who has perfected either a simple or complicated invention should file an application for a patent without delay, otherwise he may lose his rights to obtain a patent if another inventor is diligent and files his application immediately after perfecting the same invention. A recent court in refusing to grant a patent to an inventor who was first to invent a device, but last to file an application for a patent, stated the following important law:

"It is the settled doctrine of the Court of Appeals for the District of Columbia that when an inventor perfects and reduces to practice an invention, and fails for an unreasonable period to take steps to give it to the public, and until someone else has independently invented and patented it, the earliest inventor forfeits his rights to a patent against the later inventor. 83 O. G. 155, 84 O. G. 147, 87 O. G. 516, 88 O. G. 191."

Just one thing has been decided by the courts to be practically equivalent, from a priority standpoint, to filing an application for a patent.

That is, proof that the original inventor constructed a workable model and actually used it. However, the inventor is barred from obtaining a patent if he neglects actually filing an application for a patent within two years from the date he puts his invention into public use.

Although the United States Patent Office rules permit inventors to file their own applications for patents, only those experienced in patent matters and regulations should attempt to do so. In fact, the Government will not attempt to point out why or how a patent application should be written to properly protect the invention. Therefore, since the "claims" included in an application are strictly construed by the courts in determining the strength of a patent, an invention basically new, and upon which a very broad patent may be obtained by experienced persons, may be practically valueless to an inventor, where the patent is obtained by any person not especially trained in patent law and procedure. This applies to lawyers who are inexperienced in patent affairs, as well as individuals. In some instances, however, inventors who are not certain about the value of their inventions prepare and file their own applications which later may be revised by competent lawyers when the value of the invention is assured.

A patent application consists of drawings made with India ink on two or three ply bristol board 10x15 in. The specification includes a complete description of the invention with reference numerals on the drawings to clearly indicate the various parts. At the end of the specifications the inventor "claims" the features of the invention upon which he desires protection. When an application for a United States patent is prepared the drawings, specifica-

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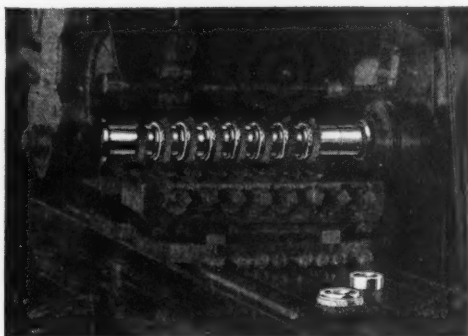
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tion, petition and oath, with the first government fee of \$20, are sent to the Commissioner of Patents, Washington, D. C.

The application remains without examination in the Patent Office for a period which is sufficient for the official Examiner to act on all cases previously filed in the same department. When its turn comes, the Examiner of the division in which the invention is classified, examines the specification, claims and the drawings, and then begins a search of old United States and foreign patents, endeavoring to locate one similar to the invention claimed in the application. If he fails to find one, then the search is continued among scientific records, magazines, and other United States and foreign publications. If the same invention has been patented by another inventor, or if a description of it has been published, the Examiner will refuse to grant a patent. If, however, he fails to find a similar

invention, he notifies the inventor, and allows the claims.

A patent is merely a certificate issued by the Government, in the form of a grant, which legally entitles the inventor to enter a court and demand damages and profits, if he believes another infringes his invention by either making, selling or using the invention. If the patent is invalid or void for any reason, or if the claims of the patent do not clearly include the device being manufactured, sold or used by the alleged infringer, the patentee cannot obtain a judgment for damages.

In other instances, if the court believes that the patent is valid and infringed, it will render a decision allowing the patentee full damages and the total profits earned by the infringer. Also, it is important to know that various courts have held that any person who makes a patented invention for his own use is an infringer to exactly the same extent as though he made and sold it.

### Beech Grove Shop Kinks

(Continued from page 20)

tion so that the jaws can be closed to the exact dimensions desired, thus making any further machining unnecessary. Hydraulic pressure is obtained by means of a locomotive air pump which is connected with a hydraulic pump. This outfit provides all the power, and is used in upsetting all other small work.

An example of the fine standard machine tools with which this shop is equipped is shown in Fig. 7, where a No. 4 Cincinnati milling machine can be seen in process of milling a keyway in a driving wheel axle. The piece is hoisted by means of a chain block, and is held in position by two clamps, as shown. The rear end of

the axle rests on a support which can easily be adjusted to the correct height. The general foreman says that this method of cutting these keyways is much faster than any he has ever seen.

### Advantages of a Central Welding Shop

(Continued from page 42)

metal product is spoiled in fabrication. The central welding department will never be idle. It will always be found busy, and practically every job done in this department will be an instance of a saving made over former methods.

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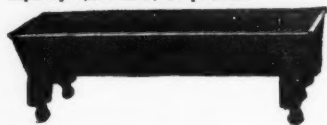
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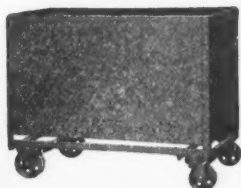
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No. 3020 F Closed Body Truck—Particularly useful where small parts are handled in bulk. Sturdily braced, large, heavy-duty casters. Capacity 1,200 to 2,000 pounds.

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## Angle Steel Equipment

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COUPON—Check, attach to letterhead, then mail!

ANGLE STEEL STOOL CO., Plainwell, Mich.

☐ Send an experienced shop equipment engineer.

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# Estimating the Cost of a Modern Factory Building

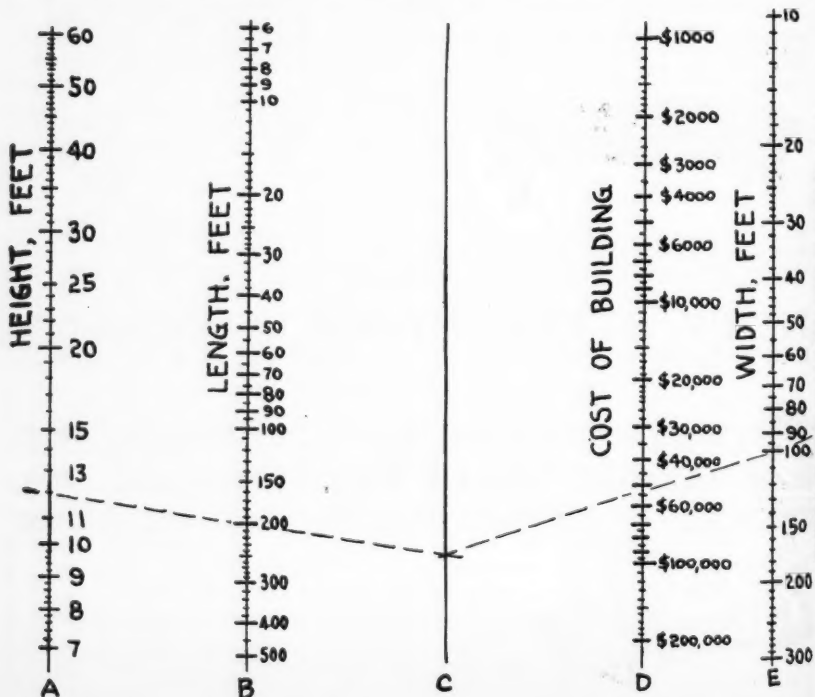
By W. F. SCHAPHORST, M. E.

**W**HEN it becomes apparent that present manufacturing facilities are inadequate, and that the necessity for a new building is imperative, the first question that arises is, "What will it cost?"

The immediate need is for an approximate cost, so that a rough estimate can be had as to the adjustments that will have to be made in order to take care of the financial end of the project. In order to obviate the necessity of waiting until an

architect can be consulted, the chart shown here has been developed. This chart is based upon experience gained through the construction of hundreds of modern factory buildings, and is considered dependable.

In order to find the approximate cost of a building of a given size, it is only necessary to draw two straight lines across the chart, from A to C and from C to E, crossing the vertical lines at points which indicate the dimensions of the building and meeting



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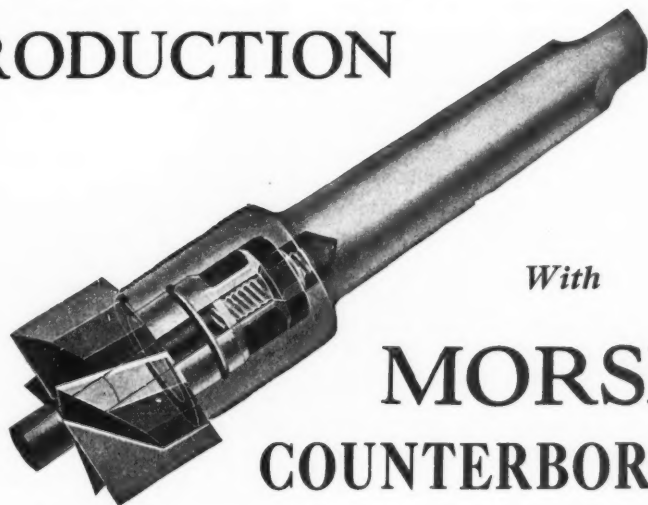
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# INCREASE YOUR PRODUCTION



*With*

## MORSE COUNTERBORES!

THE minute you use Morse Counterbores you are assured of a maximum production at a minimum cost. Morse design includes many features which increase the efficiency of the tools.

The first outstanding feature is the ease with which the cutters can be changed. A simple twist of a screw driver or the tang of a file is all that is necessary to remove the cutter from the holder. It will disengage immediately, leave no burrs, and will not jam in the holder.

Consider, next, the positive drive. The cutter is driven by a hexagon milled on the end of the shank. It has no set screws, balls, pins, coil springs, and is not held in by the pilot.

The rugged construction of the Morse Counterbore makes it as rigid as a solid tool. The pilots are locked in the cutter with a split nut and are accurately centered.

This tool, and the complete line of Morse production increasing tools, are fully described in the Morse catalog. Send for your copy today.

## MORSE COUNTERBORE & TOOL CO.

12281 TURNER AVE.



DETROIT, MICH.

at the line C. For example, if the height of the factory is to be 12 ft., the length 200 ft. and the width 100 ft., a line should be drawn from the point indicated at 12 on line A through the point indicated as 200 on line B and on across line C. Beginning at the intersection with line C, a line should be drawn to the point indicated as 100 on line E. The figures shown at the intersection with line D comprise the approximate cost of the building, which in this case is \$53,000.

It will be noted that the limitations of this chart are very wide, the height, as indicated by column A, being from 7 to 60 feet. The length varies from 6 to 500 ft., as indicated by column B, and the width, column E, from 10 ft. to 300 feet. The costs included vary all the way from \$1,000 to \$200,000.

In developing this chart, it has been assumed that reinforced concrete would be used, with flat slab ceilings and without beams or girders. This type of construction permits uninterrupted distribution of light and low cost installations of sprinkler equipment, shafting, and so on. Ceilings are usually about 12 ft. high and columns are approximately 20 ft. apart. A factory 60 ft. high is unusual, of course. Floors are usually designed to sustain working loads of 125 lb. per square foot, and are finished with cement.

It is also assumed that the modern type of steel windows which have been developed for factory construction will be used. Such windows, with ventilating units, will fill about 50 per cent of the wall area. This type of construction insures plenty of daylight and air. Inside walls are usually painted with cold water paint. If particularly good illumination is desired, however, oil paint is generally used instead of the cold water var-

iety. The distribution of artificial illumination is usually based on the measure of current used, and is generally figured at one watt per square foot of floor space.

Provision is also made for a steam heating plant to be located in the basement, with wall-type radiators, which are usually placed under the windows. The number of radiators is sufficient to maintain a temperature of 70 degrees F. inside the building during zero weather.

In estimating the amount of sprinkler equipment necessary, it is common practice to allow one head for each 90 sq. ft. of floor area. The plumbing varies with the number of employees and with the requirements of state and municipal laws. Partitions generally are of hollow tile, 4 to 6 inches thick. Many of the best construction engineers estimate the elevator equipment needed on a basis of one 3,000-lb. capacity car for each 100x100-ft. building. Two cars are allowed for a 100x200-ft. building.

In planning the height of the floors, consideration is usually given to the matter of unloading from box cars, the floors of which are about 4 ft. 2 in. above the rail tops. Truck bodies are usually figured as being 3 ft. 8 in. above the surface of the ground. If the first floor is placed approximately 4 ft. above the ground, the task of loading or unloading will be facilitated. Permanent shelter for protecting merchandise during loading operations in the event of rain or snow is also provided for.

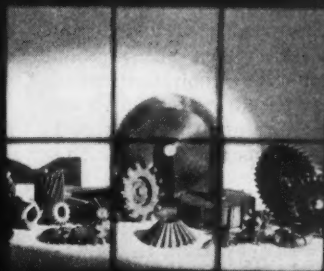
Altogether, this chart covers the cost of a first-class building.

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The most progressive manufacturer can give you the best service. The manufacturers represented in these pages are leaders in their industry; patronize them and mention MODERN MACHINE SHOP when doing so.



# For Better-Ground Tools and Cutters



## A Completely Motorized Machine

THE Norton Universal Tool and Cutter Grinding Machine is a sturdy, rugged machine especially designed for all kinds of tool room work—cutter, reamer and tool grinding and sharpening as well as light surface, cylindrical and internal grinding.

Individual motors—for wheel, headstock and table drives—eliminates all unsightly overhead works, pulleys and belts, and provide the utmost economy and convenience of operation.

**NORTON COMPANY**  
Worcester, Mass.



M-220

## Photomicrograph Explains Surface Cracks

By JOHN H. MARCHMONT

**L**ACK of knowledge of heat treating processes often brings about difficulties in the toolroom which might be prevented, and failures are often charged against the heat treatment which properly belong else-

started outside of the hardening room.

It is a known fact that when uneven cooling is the cause of cracks, the cracks are curved and are often nearly circular in appearance. When the cracks are due to a too-high tem-

perature, the cracks fracture and appear coarse-grained.

Moreover, the steel is very brittle. The photomicrograph shown here indicates that the cracks were caused in the grinding operation. None of these cracks could be seen with the naked eye, whereas they stand out conspicuously



Photomicrograph showing cracks caused by grinding.

where. A very interesting example of this fact which occurred recently proved to the diemakers in one shop, at least, that all cracks are not due to heat treatment.

Trouble was experienced with a certain piece, and, as usual, the heat treatment was blamed. In consequence, especial care was taken during heat treatment to eliminate the three most common causes of cracks; uneven heating, too high hardening temperature, and uneven cooling. The specimen shown in the illustration was photographed with a microscopic camera after hardening, with the result that an investigation was

when the steel is etched and placed under the microscope.

Investigation disclosed that the man who was doing the grinding was using neither the proper grade wheel nor the correct feed on this operation. By changing the wheel and the feed, considerably less heat was generated in the grinding operation and the piece was finished with a perfect surface. The moral of this lesson is that surface cracks are often caused by grinding and it is just as necessary, therefore, to watch the grade of wheel used and the speeds and feeds as it is to watch the methods used in heat treating the piece.

# HIGH SPEED AUTOMATIC TAPPING MACHINE

**Automatic  
Dial Feed**



**Three  
Speeds**



**Automatic  
Knockout**

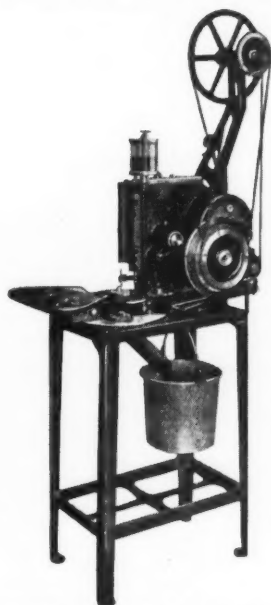
**Wide  
Range**



**Simple To  
Operate**



**Increases  
Production**



The H & H Automatic Tapping Machine

For the tapping of small parts, the "H & H" Automatic Tapping Machine is ideal.

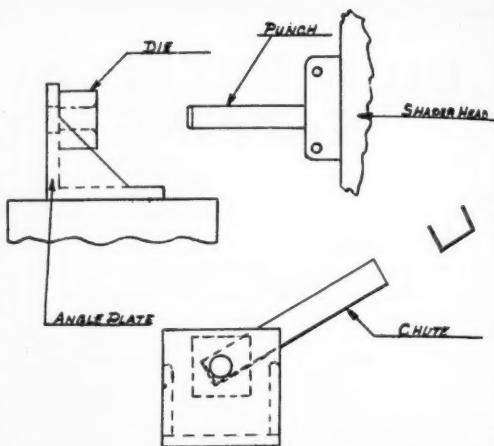
Forty-five, sixty-five, and eighty-five strokes per minute.

Dial Feed. Operator has but to feed the dial. The automatic indexing and knockout finishes the part.

No complicated jiggling required. Machine can be used on many parts.

**INDEX MACHINERY CORPORATION**  
49 CENTRAL AVENUE CINCINNATI, OHIO

for "running-in" gears. A hardened and ground master gear A was attached to an arbor which was inserted into the spindle of the machine, then a fixture was built to hold the gear which was to be lapped C in mesh with the master gear, as shown. The fixture B consists of a base carrying a spindle set into two bearings, with a pulley between. The end of the spindle serves as an expanding arbor, being split and having a screw in the end which screws into a taper hole to obtain the necessary expansion. The rear end of the shaft is squared, as shown at D, so that the spindle can be held stationary while the piece is chucked. In order to obtain the necessary tension between the master gear and the gear to be lapped, a belt is attached to one side of the machine and swung over the pulley with a weight at the free end. This weight retards the action of the spindle just enough to keep the gear-teeth tightly in mesh. Power is applied through the cone of the lathe. A lapping compound, composed of abrasive and oil, is applied with a brush while the machine is in motion.



Equipment for Reducing Diameters of Aluminum Cups

made through which the cups were forced by the ram of an arbor press, but this method was too slow.

In order to increase production, the die was attached to an angle plate, and a punch, shown in the illustration, was made for use with a shaper. The hole in the die was straight excepting for a  $\frac{1}{4}$ -in. radius at the receiving end, and 3.010 in. diameter. As the stock was .025 in. thick, the punch was made 2.960 in. diameter. The pieces were located accurately and production was maintained at the maximum by the use of a chute, which reduced the operator's task to keeping the chute filled. A cup would roll into place at each return of the ram. Production was increased from 90 per hour by the arbor press method to 2,160 per hour by the use of the shaper.

## Reducing Diameters of Aluminum Caps

By C. M. CARPENTER

A NUMBER of aluminum cups were delivered to us for use in assembling some special machines, but upon attempting to use them, the cups were found approximately .008 in. too large in diameter. As we needed them immediately, we were put to the necessity of finding means for reducing the diameters to the correct size. Accordingly, a die was

## Frictional Clamping of a Screw

By R. H. KASPER

THE design of a certain machine involved the use of an adjusting screw which was required to be held

# The New 221 $\frac{1}{2}$

## Self-Oiling All-Geared Drill

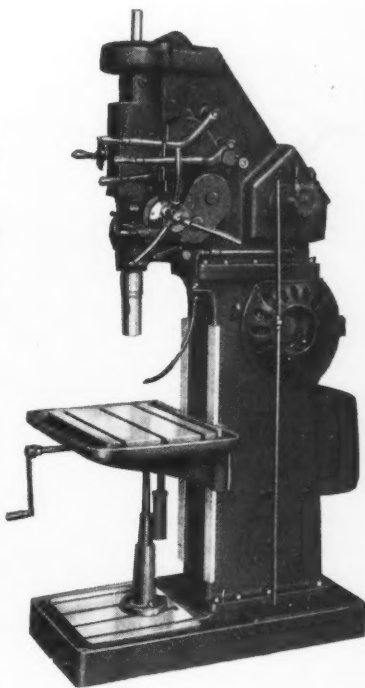
**THIS** machine—new throughout—is an addition to the Self-Oiling, All-Geared Line. It is a companion machine to our well-known No. 242, has the same features, is equally rigid, compact, efficient—equally productive on a smaller range of work.

The new 221 $\frac{1}{2}$  drives a 1 $\frac{1}{2}$ " high speed twist drill to capacity. It drills to the center of a 22" circle—has 8 quick change spur geared feeds—an equal number of quick change speeds—an automatic reverse 1 $\frac{1}{4}$  to 1. Also available with 4 quick change speeds or single speed as specified.

One of the outstanding features of this new machine is the six splined Nitralloy spindle, hardened by the Nitriding process, and running in roller bearings mounted in recesses at each end of the hardened spindle sleeve. This new and more compact construction eliminates bearing cases and raceways. It has proven extremely durable in the most strenuous tests conducted under actual service conditions. The spindle sleeve is **WHOLLY ENCLOSED** and Self-Oiling. Its assembly and adjustment are facilitated by a Gunite cap on the spindle bearing. The crown gears which drive the spindle are hardened steel **SPIRAL BEVELS**, available in three ratios. Steel spiral bevels are also used in main drive and reverse.

The complete anti-friction bearing equipment, centralized controls at front, clearly indicated speeds and feeds, drives, optional equipment and attachments which increase production and lower costs on drilling and tapping operations are described in our catalog—send for it today.

*Ask for Catalog "U"*



## Barnes Drill Co.

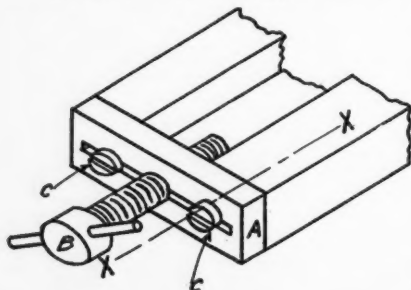
801-851 CHESTNUT STREET

ROCKFORD

ILLINOIS, U. S. A.



so that it could easily be turned by hand, yet had to be held in such manner that it could not be turned by the vibration of the machine. As space did not permit of the application of



The screws C provide for adjustment of tension on screw B



### SECTION X-X

the usual screw clamping methods, the following method was followed:

The plate A was drilled and tapped to take the adjusting screw B and the two fastening screws C. The heads of the screws C were tapered on the under side, and the holes in the plate A were reamed accordingly. A slot was then milled in the center of plate A, the slot extending past the tapered screw holes. The plate A was then squeezed, closing together the tapped holes for the screw B. Plate A was then assembled to the machine by the screws C, the tapered heads of the screws serving to spread the slot until the desired amount of tension was ap-

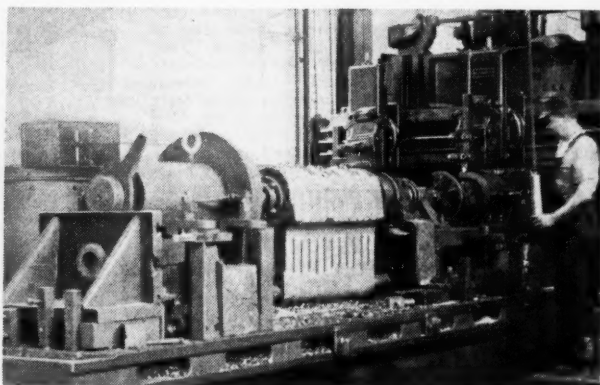
plied to the screw B. The tension on the screws C holds them from turning and thus these screws hold the plate A securely in position.

## Fixture For Machining Eccentric Crank Arms

By J. H. HAHN

THE illustration shows a planer fixture with which the cost of machining locomotive eccentric crank arms was reduced from \$15.00 to \$6.10. The old method produced one piece at a time, while by the new method, in which this fixture is used, 12 arms are finished in one operation.

The sequence of operations on these arms is as follows: Face both sides; bore for the main crank pin fit; slot the keyways, bore for eccentric crank arm pins; machine radii on ends. In order to machine the radii, the 12 crank arms are placed on a mandrel with a key to fit into the key-



Fixture For Machining Eccentric Crank Arms

ways and thus keep the arms in alignment. A mandrel is also slipped thru the holes in the lower ends of the arms to aid in keeping them in line while the operation is in process.

(Continued on page 100)



# The Modern, Silent Gear

Formica gear material is carried in stock by scores of the best gear cutters in every part of the country, and they can give quick service when a machine is shut down and a new gear is needed.

Formica can work in moisture, fumes and other difficult conditions that would ruin some non-metallic gear materials.

Quiet operation makes all machinery easier to sell. Quiet machinery sounds well maintained and cared for. Quiet increases production.

Ask for Formica the next time you order gears.

**THE FORMICA INSULATION COMPANY**  
4632 SPRING GROVE AVENUE CINCINNATI, OHIO

The logo for Formica, featuring the word "FORMICA" in a bold, sans-serif font. Above the letters is a thick, curved line that arches over the text, resembling a stylized roof or a protective shield.

# Across the Desk with

HOWARD CAMPBELL, *Editor*

ONE of the most pleasant experiences of the past year was that of meeting, at the Machine Tool Show, a large number of our readers from all parts of the United States. The many cordial greetings from those whom we have been addressing through these columns will long be remembered. How many times we have wished that we could have the time and the opportunity to sit down in our own office or the "other fellow's," and talk about the things in which we are both most interested. While we do get out into the various parts of the country many times in the course of a year, this is not enough.

So, inasmuch as we cannot actually sit down and face each of our readers across the desk, we hope to accomplish the same result, as far as possible, through this page. We want MODERN MACHINE SHOP to serve as a clearing house for ideas in our field—a conference room where our 27,000 readers can get together and both learn and see what the "other fellow" is doing—and we hope that each one to whom this magazine goes will send his criticisms, comments, or praise (if any) just as though he were addressing us face to face "across the desk."

THE article on "Non-Ferrous Metals and Alloys" on page 22 of this issue is the first of a series on this subject by Professor Enos of the University of Cincinnati. The series on "Nature and Properties of Iron and Steel," which ran the early part of last year, proved so popular that we were still receiving requests for copies containing these articles long after

the series was completed; in fact, the requests for extra copies of the January issue were so numerous that we ran out of office copies entirely. We suggest that those who have not been saving their copies of MODERN MACHINE SHOP begin doing so with this issue; the practical usefulness of the articles that have been planned for this year will make them well worth keeping for reference.

THE past year has witnessed a number of developments of great importance to the metal-working field; the coming year will be productive of others just as important. That this is the age of opportunity there can be no doubt—but opportunity knocks only at the doors of those who are prepared to receive it.

The wise man profits by the experience of others. No brain, however good, can produce more than a certain amount in a given period of time, but the results of the thought and effort of hundreds of others during this same period can be recorded for the benefit of all, and thus the ability of one man is multiplied many times through the medium of the business or technical magazine.

The editor of MODERN MACHINE SHOP has planned, for the coming year, an editorial program which will include discussions of the methods in use in some of this country's most representative machine shops. It is our wish that each person who receives this magazine may find it both interesting and helpful, and that we may, in this way, have a share in making each reader's New Year a happy one.



# SUPERIOR

## "Quality"—

Upright Drilling and Tapping machines, continue their quarter of a century record of constantly meeting the demands of present day *production* requirements.

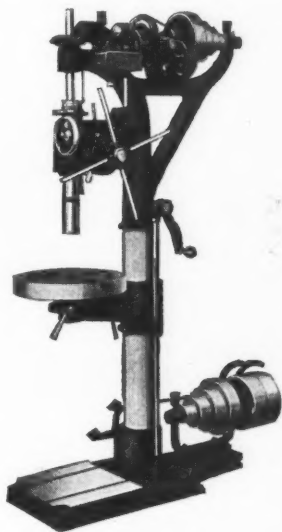
Covering a complete range of sizes from 10" to 36" inclusive, and furnished in various types with all parts made on an interchangeable system, there remains no argument for the most *discerning* buyers of modern Drilling equipment.

*Our latest catalog just off the press will prove very interesting.*

In addition to our serving you with Drilling and Tapping equipment of the *highest quality*, we offer you the services of our *competent* staff of Drilling Engineers who are *specialists* in *better drilling methods*.

Your request for their recommendations will receive immediate, careful attention.

No obligation, *merely a part of our* SUPERIOR Drilling SERVICE.



20" SUPERIOR  
Code B-one

# SUPERIOR MACHINE TOOL CO.

KOKOMO

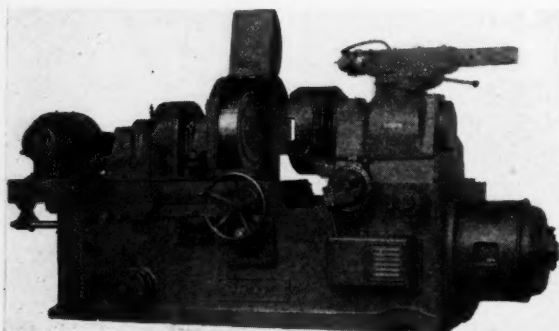
SINCE 1902

INDIANA

## New Shop Equipment

### Improved Model Cincinnati Brake Drum Grinder

The Cincinnati Brake Drum Grinder now being offered by Cincinnati Grinders, Inc., Cincinnati, Ohio, embodies features which constitute a considerable improvement over previous models.



(Above) — Improved Model Cincinnati Brake Drum Grinder. (Right) — Rear View, Showing Individual Motor Drive Vertical Coolant Pump.

More safety for the operator is provided by the fully-guarded grinding wheel. The guard is of cast steel and is removable. The mounting of the precision grinding wheel spindle on anti-friction bearings is another valuable improvement.

To bring the grinding wheel into the work the required distance, an independent in-feed attachment driven by a fractional horse-power motor is provided, in addition to the hand feed. A dead stop is provided, arranged for use with either the power or hand in-feed. Sizing by means of the dead stop can be facilitated by the use of dial gage permanently located in contact with the

ground surface. A micrometer indexing mechanism is also provided for close setting. The grinding wheel truing equipment is mounted on the top of the wheel-head and is operated by a hand lever, with which it is quickly brought into position for truing. An independent valve supplies coolant for wheel dressing. As shown in the illustration, an improved individual motor drive vertical coolant pump is located at the rear of the machine.

The grinder has capacity for work up to 26 in. diameter, thereby permitting not only the handling of unmounted drums, but also wheel and drum assemblies. Inside diameters up to 22 in. can be ground on mounted drums. A 21½-in. rotary-type magnetic chuck with a hardened and ground steel centering

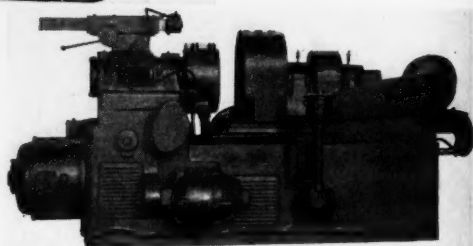


plate holds the work. Mechanical reciprocation of the work over a short stroke while the grinding wheel is automatically fed into the work keeps the ground surface free from wheel marks and insures an exceptionally smooth braking surface for the drum. To facilitate loading and unloading, the travel of the work-head is air-controlled from a small valve conveniently placed at the operator's left hand.

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"A wheel

## LITTLE LESSONS IN GRINDING COSTS

IT WAS Harry Bennett, one of SAFETY'S old timers speaking:

"The point is, Mr. Black, that, while that other equipment may cost a little less to buy, it certainly will cost you more to use. And it's the every-day cost of grinding that's the important thing.

"This other proposal involves the use of 30" x 2½" wheels with 20" centers, the wheels to be discarded when they're worn down to 23" diameter. The list price of a 30 x 2½ x 20" wheel is \$133.00. In wearing it down to 23" diameter, 729 cu. in. of abrasive material is used up. That makes the cost at list price 18.2¢ per usable cu. in. of wheel.

### SAVING ⅓ OF THE COST OF WHEELS

"Now see for comparison how the cost figures out on the 30 x 2½ x 12" wheels we are recommending on this job. The list price is \$158.13. The usable volume in wearing it down to 15" diameter is 1,325 cu. in. That makes the list price per usable cu. in. of wheel 11.9¢—less than two-thirds the cost of the other wheel. Using two wheels to the machine, and figuring each wheel to last a week on your work here, that means you would use in a year's time 100 of these

wheels with 12 inch centers or 182 of the wheels with 20 inch centers. It would cost you 53% more to use the large-hole wheels than to use wheels which can be worn down to 15" diameter as the SAFETY "Rite-Speed" grinder permits you to do. The difference in list price of the year's supply of wheels, in actual dollars, would be \$8,393. Even after you deduct your regular discount from list price, that's a whale of a difference. It will pay the full price of a "Rite-Speed" grinder several times over.

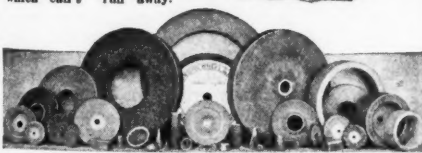
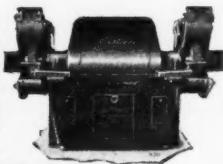
"Now, sir, what do you say? Even if you overlook the greater efficiency of the "Rite-Speed" grinder, can you afford to get along without it? It will more than save its cost by using up practically the entire wheel. And it will automatically enforce the correct cutting speed of the wheel as it wears down."

\* \* \* \* \*

And what do you say? Can we be of assistance to you in reducing your grinding costs, too? As manufacturers of both wheels and machinery, we are accustomed to looking on both sides of a grinding problem, without compromising either factor. Can you afford these days to overlook any possible saving in costs? The coupon is for your convenience—and for your satisfaction.



The SAFETY "Rite-Speed" Grinder automatically enforces an increase in speed as the wheels wear down. Yet this increase in speed is accomplished mechanically, not electrically. This permits the use of a constant speed A. C. Motor—which can't "run away."



### THE SAFETY GRINDING WHEEL AND MACHINE CO.

2314 Columbus Ave., Springfield, Ohio.

Please send us file data regarding

- ☐ "Rite-Speed" Grinders.
- ☐ "Safe-T-Bond" High Speed Wheels.
- ☐ Other SAFETY Products.

.....  
Name of Individual

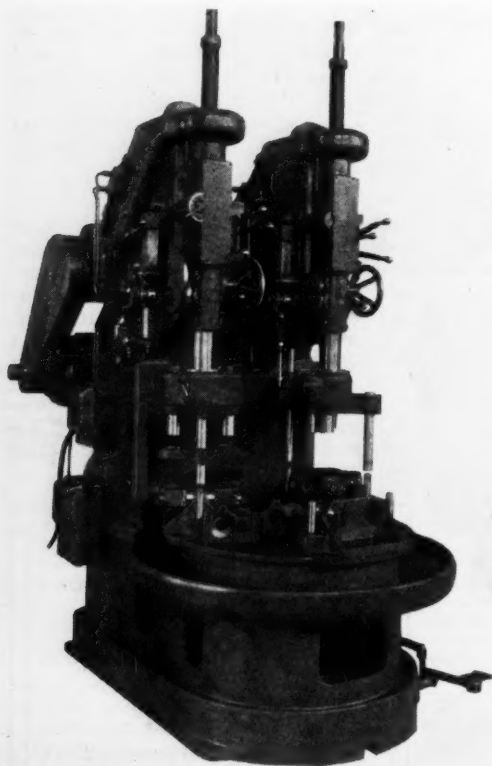
"Pin this to your letterhead"

"A wheel for every need"...backed by 37 years' experience

This grinder is operated on the plunge-cut principle, which reduces operating time to the minimum. The machine is entirely self-contained, the grinding wheel being driven by a 40 h.p. motor which is built into the machine. The work-head is powered by a 5 h.p., variable speed d.c. motor. A generator, mounted on the bed, supplies 230 volts d.c. to the head-stock motor. A rheostat located within reach of the operator, controls the various feeds of the work, and a dynamic brake is provided to stop the work instantly.

### Barnes No. 242 Special Two-Spindle Production Gang Drill

The illustration shows a special two-spindle Production Gang Drill built by



Barnes No. 242 Special 2-Spindle Production Gang Drill.

the Barnes Drill Company, 840 Chestnut Street, Rockford, Illinois, along the same principles as the Barnes No. 242 Production Self-Oiling All Geared Drilling and Tapping Machine described in the November, 1929, issue of MODERN MACHINE SHOP.

In addition to the construction and operating features described in the above-mentioned article, this machine has a rotating hydraulically controlled table built into the one-piece base and completely surrounded by a large coolant and chip trough. A chip sweeper is fastened to the underside of the rotating portion of the table, which pushes the chips to the rear where they fall into a steel pan. The pan can easily be removed and emptied through the rear of the column.

The hydraulic controlling mechanism for indexing the table is completely enclosed in the frame of the machine. A convenient foot lever controls this mechanism, which, when operated, starts both spindles on their operating cycles. The machine as illustrated is equipped with three indexing stations. While the operator loads the station at the front of the machine, the spindle at the right drills two pieces of work and the spindle at the left reams the two pieces previously drilled. The operating cycles of the two spindles are completed by the time the operator has the front spindle loaded. He then depresses the foot pedal, indexing the table and automatically engaging the clutches on both spindles for another cycle of operation.

The first spindle of this machine is equipped with a Barnes Cam Feed, which gives a rapid approach, feeds at a predetermined rate, dwells for facing, and provides a quick return to the starting position. The second spindle has a similar cam feed adaptable for both reaming work and a tapping lead. This operating cycle is controlled by the cam feed, which can be changed to suit the requirements of the work.

This machine can be supplied with spur gear feeds, with or



# FOSDICK

3-foot, 4-foot, 5-foot 6-foot, 7-foot

## "ECONOMAX" RADIAL DRILL for heavy duty drilling

Universal control at head.

36 spindle speeds.

18 feeds and 3 pipe-tap leads.

Hardened alloy steel gears.

Automatic lubrication.

Tapered roller bearings.



Extra large alloy steel spindle with six multiple splines.

High pressure lubrication of spindle.

Power rapid traverse of head on arm with friction drive.

Quick return of spindle.

Dial divided into even inches.

Tapping and driving mechanism with indestructible multiple disc frictions.

The combined results of years of experience in designing and building drilling machines are incorporated in the design of this machine. It is a beautiful example of modern engineering skill.

*Ask For Specifications*

### THE FOSDICK MACHINE TOOL CO.

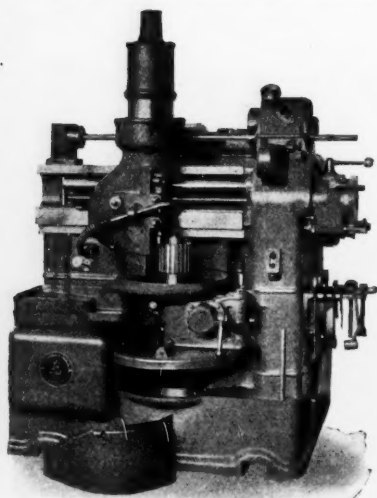
CINCINNATI, OHIO, U. S. A.

without the cam feed, as well as the Barnes geared thread leading feed for tapping and threading operations. Multiple drill heads can also be attached to each spindle, thus increasing the capacity of the tool.

The total height of this drill is 120 inches. Floor space required, 90 inches x 56 inches, weight, equipped with a 10 h.p. motor and all attachments, 9760 pounds net.

### Improved 6-A Type Fellows Gear Shaper

A number of improvements have been made in the design of the 6-A Type Fellows Gear Shaper which are intended



Improved Model of 6-A Type Fellows Gear Shaper

to simplify the machine from an operating standpoint.

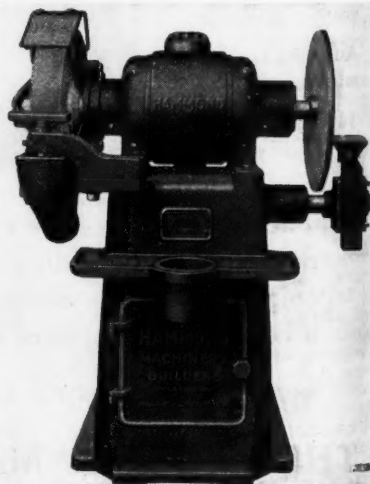
One of the additions, shown in the illustration, is a bracket which provides a holder for all of the wrenches and tools used in the operation of the machine. Another change, which is especially convenient where the machine is being used for production work, is the addition of an opening in the cabinet to facilitate the cleaning of the compound tank. A removable plate has been added for convenience in filling the oil reservoir in the stroke gear box.

and a motor bracket of more simple design has also been added.

One of the principal improvements in the machine is the introduction of a friction disc clutch and a single pulley drive. This mechanism is completely enclosed by a hinged guard. Incorporated with the single pulley drive is a disc brake located on the main drive shaft which enables the operator to stop the cutter travel at any desired point, a feature which is found extremely convenient when setting up the machine. The capacity of the machine remains the same—18 in. P. dia., both external and internal, and 5 in. face external with 3 in. face internal,  $\frac{3}{4}$  Diametral Pitch.

### Hammond Combination Disc and Production Grinder

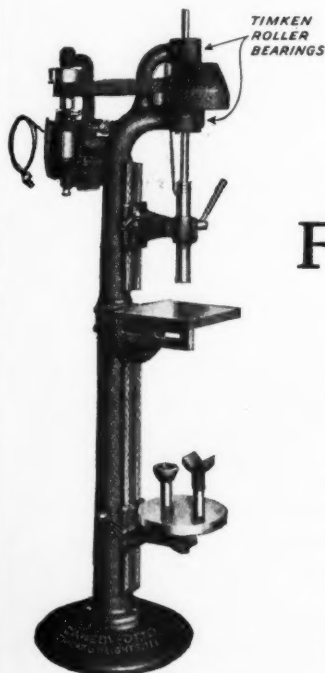
A combination disc and production grinder, shown in the illustration, has been placed on the market by the Hammond Machinery Builders, Kalamazoo, Michigan. The machine is particularly adaptable for use where the amount of disc grinding to be done is limited, as the solid grinding wheel can be used for tool or casting grinding, rendering a dual service. The machine can, however, be fitted with discs at both ends



Hammond Combination Disc and Production Grinder

# "Ready For the Job"

—delivery is the first cost-reducing feature of this machine. A square and round table are included as standard equipment on this



**CATALOG  
UPON REQUEST**

## CANEDY-OTTO 14-in. Sliding Head Sensitive FLOOR DRILL

IT IS a fast, accurate production machine for holes from 0 to  $\frac{1}{4}$ ". It can also be furnished in multiple spindles, either bench or floor type. Cone pulley runs in Timken Roller Bearings, spindle runs in ball thrust bearing supported by sleeve with extra long bearing.

Vertical motor attachment simplifies power transmission, and eliminates idlers, pulleys, twist and turn belts, and reduces the power required for efficient operation.

The spindle speeds are 400, 850, and 1,750 R.P.M. This drill can also be furnished in combination speeds as follows: 525, 1,400, 3,000 R.P.M.; 1,000, 2,200, 5,000 R.P.M.; and 3,400, 5,600, 10,000 R.P.M.

**CANEDY-OTTO**  
CHICAGO HEIGHTS, ILL.



New York Branch:  
407 Broome St.  
New York City

*Complete Stock At  
All Branches*

San Francisco Branch:  
955 Folsom St.  
San Francisco, Cal.

and with either plain or universal lever tables.

The machine is equipped with a totally-enclosed 40-degree C.-type motor, fitted with a motor air cleaner which supplies clean air to the motor windings and thus prevents dirt and grit from entering the motor. The motor is operated through a push button control and automatic motor starter having thermal overload protection, low voltage, and phase failure protection. High-grade ball bearings, completely enclosed and protected from dust by double labyrinth seals, take both radial and lateral thrusts. Liberal oil reservoirs are provided with convenient oil cups, oil lever gage, and drain plug for ease of flushing the bearing chamber. The oil chamber is designed so that surplus oil will run out through an overflow located at the wheel end of the bearing compartment, away from the motor windings. The disc wheels are machined on both sides so that they can be reversed.

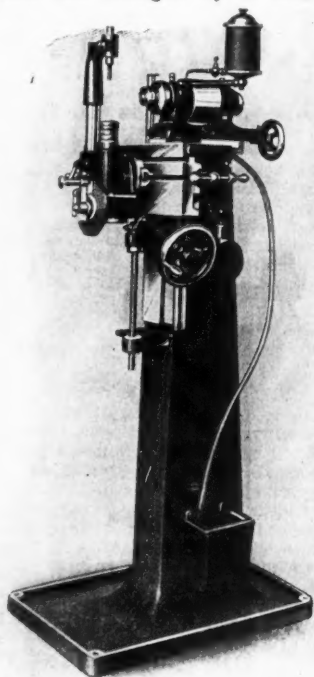
The machine is made in four sizes—2, 3, 5 and 7½ h.p. capacity, for 220 or 440 volt, 25 to 60 cycles, A. C., and for 110 or 220 volt D. C. Standard equipment includes one steel adjustable wheel guard, steel disc, and plain table as shown.

### Deckel Universal Tool Milling Machine

The Index Machinery Corporation, 49 Central Avenue, Cincinnati, Ohio, is now marketing a milling machine especially designed for tool or pattern work, and known as the Deckel Universal Tool Milling Machine. The machine is 64 inches high, with a base 16 x 22 inches. The machine is universal in every respect, being so designed that the headstock can be swiveled approximately 30 degrees to the right or left, with a graduated dial to control the horizontal movement. The dividing head can be swiveled, inverted, or placed in a horizontal position.

The working surface of the table is 6¼ x 18 in. The longitudinal table feed is 9½ in. and the vertical table feed is 8 in. The horizontal feed of the spindle head is 5 in. Spindle speeds range from 105 to 1070 r.p.m. The spindle hole is ½ in. diameter, and the capacity of the spring collect is ½ in. The countershaft enables the user to obtain eight speeds forward or four speeds forward and four reverse, which is intended to cover

speeds required for practically any job that would be done in this machine. Speeds are changed by a lever con-



Deckel Universal Tool Milling Machine

veniently placed at the side of the machine. Power required, ¾ h.p. net weight including countershaft, 790 pounds.

### New Cincinnati Semi-Automatic Plunge Grinder

A new Semi-Automatic Plunge Center Grinder which embodies in its design a special adaptation of the centertype principles of grinding to the units usually employed in centerless grinding, has been developed by Cincinnati Grinders Incorporated, Cincinnati, Ohio.

The frame work of the No. 3 Centerless Grinder serves as the basic unit about which the machine is constructed. In place of the regulating or feed wheel used on centerless grinders, an extended spindle which is employed as a work-

A watch valued at \$400 and  
mond rings were in the loot.

register and escaped  
auto driven by a confederate.

# NINETY YEARS IN MACHINERY BUSINESS

## Precision Machinery Builders Since 1840

Ninety years ago the BRADFORD Machine Tool Company, 659 Evans Street, Cincinnati, Ohio, entered the machinery business as builders of high-grade machinery.

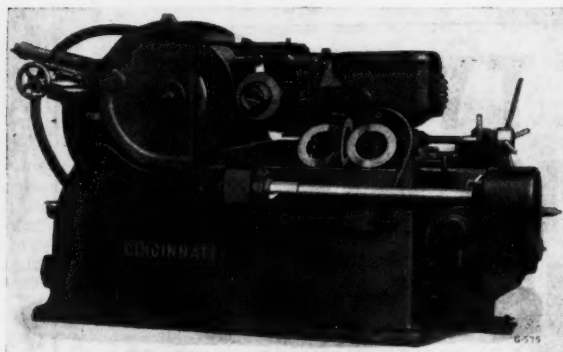
Today, the BRADFORD latest improved "All-Geared" engine lathe is known throughout the industry as one of the most efficient precision lathes built. The design of this machine includes the thirty-five lathe fea-

tures which should always be considered when purchasing a new lathe.

BRADFORD also builds special drilling and tapping machines which consist of BRADFORD drill heads arranged in any combination to suit your work. These machines will give satisfactory results wherever a high production schedule must be maintained.

DRILLING HEADS

arbor is supplied on this new machine. Parts, such as clutch facing rings, transmission stub shafts, discs of various types, brake shoes, and so on, are mounted on a hollow mandrel which is placed in the spindle. A bayonet lock secures the mandrel quickly.



Cincinnati Semi-Automatic Plunge Cut Grinder

The movement of the work slide to the grinding wheel is cam-controlled. By throwing a single hand lever, shown by the arrow in the front of the machine, the work starts to revolve and feed into the grinding wheel. The cam controlling this movement is so arranged that the work advances rapidly to the grinding wheel, then proceeds at a slower rate until the correct diameter has been ground. A short period of time is then allowed for a complete rounding-up action and the work then backs rapidly away from the grinding wheel and rotation of the arbor stops automatically. This semi-automatic work cycle reduces non-grinding time to a minimum.

The in-feed work slide is arranged for reciprocation up to  $\frac{3}{8}$  in. maximum and also for an up and down oscillation. An individual motor drives the oscillation, or up and down movement, of the work slide. The desired reciprocation of the work slide is obtained by an eccentric arrangement on the trunnion. All of these movements are auto-

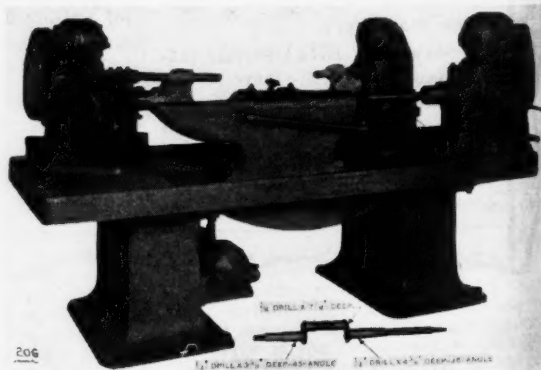
matic, a single movement of the lever at the front of the machine starting the cycle of feeding, oscillating, reciprocating and backing away.

By operating on the plunge cut principle, stock is removed at a fast rate. Provision for this is made by equipping these machines with built-in motors having a horse power rating as high as 40 h.p. This new grinder is capable of using the 24-in. diameter grinding wheel to the very limit of its cutting capacity.

Work up to  $15\frac{1}{2}$  in. diameter can be accommodated on this new grinder. The 10-in. wide grinding wheel provides a maximum grinding contact for handling a large number of parts in one grinding cycle. When grinding clutch facing rings, 60 are mounted on the mandrel and two mandrel loads are ground to exact dimensions each minute—a production of 6,000 finished pieces an hour.

## Bradford Three-Head Drilling Machine

The illustration shows a Bradford Three-Head Drilling Machine which has been built for drilling gas engine crank-



Bradford Three-Head Drilling Machine.



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# 4 Operations with 1 Set-Up



## TURRETS



**A**NOTHER lathe job showing how McCrosky Turrets save set-up time. The job is machining valve pistons. Four operations are performed on each casting—turning, facing, chamfering, and cutting grooves for packing rings. The four tools are mounted in the McCrosky Turret at one set-up. As each tool is needed, a half-turn of the clamping handle raises the body from the base, allowing it to be swung into position for the next operation and reclamped.

McCrosky Turrets are ruggedly built to stand up under hard work. The patented indexing mechanism, the heart of the McCrosky design, is positive, powerful, and accurate.

There are 10 styles and many sizes of McCrosky Turrets. Bulletin No. 11-C will help you determine the right Turret for your lathe. Send for a copy.

# McCROSKY TOOL CORPORATION

MEADVILLE

[ Branches in Cleveland, Detroit, Chicago, Toronto ]

PENNSYLVANIA

shafts for the Westinghouse Electric & Manfg. Co. The shafts are of S. A. E.-1035 steel, and the operation includes the drilling of one angular oil hole  $\frac{1}{4}$ -in. dia. by  $4\frac{1}{2}$ -in. deep, one angular oil hole  $\frac{1}{4}$ -in. dia. by  $3\frac{1}{2}$ -in. deep, and one connecting hole through the throw  $\frac{1}{8}$ -in. dia. by  $7\frac{1}{2}$ -in. deep. The cutting speed is 70 feet per minute.

To operate, the operator clamps the work into the fixture, then trips the feeding mechanism of all heads simultaneously by the operation of the hand valve at the front of the machine. The master head, located at the right front of the table, completes its first cycle, drilling to a depth of four inches before the  $\frac{1}{4}$ -in. drills can penetrate the connecting hole. This spindle then returns to the starting position and after the two  $\frac{1}{4}$ -in. drills have started on the return stroke, the operator advances the master head to the front station in the slide by means of the hand lever on the front and trips the feed of this head for a second cycle to obtain the full depth of  $7\frac{1}{2}$  inches. The time, floor to floor, is six minutes.

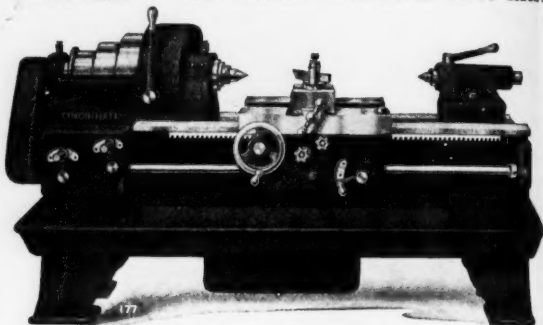
### Cincinnati Maxi-Production Lathe

Carbide and other tungsten carbide tools can be utilized at their greatest efficiency in the new Cincinnati Maxi-Production Lathe, which has been placed on the market by the Cincinnati Lathe & Tool Co., 3211 North Street, Cincinnati, Ohio. The design of the machine incorporates a number of conveniences which are intended to enable the operator to obtain maximum production with a minimum of upkeep, and the construction embodies rigidity, extreme precision, and simplicity. The machine is built to withstand the heavy cuts possible with tungsten carbide tools without undue vibration, and is particularly adapted for high speeds.

The spindle can be started or stopped instantly by operating the lever on the headstock, this lever serving to control the movement of a positive friction clutch and brake. The headstock is built for heavy duty work, and will be

supplied either with or without back gears. The spindle is of 60 point carbon forging, with  $2\frac{1}{2}$ -in. hole throughout to accommodate bar stock. The spindle operates in Timken Roller Bearings, which reduce friction to a minimum and provide for long service without wear. The tailstock can be supplied with either the standard screw feed or a quick-acting mechanism. The feed box provides for an unlimited range of feeds, from the coarsest to the finest.

The machine is made in three sizes:

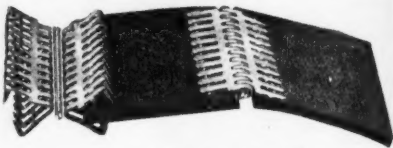


Cincinnati Maxi-Production Lathe

17, 19, or 21-in. swing, and with beds of any length from 6-ft. up. Regular equipment includes double plate apron, plain block rest, bush with two centers, self-oiling, two-speed countershaft, automatic stop, screw-operated tailstock, large and small faceplates and wrenches. Weight, net, 3260 pounds.

### "Steelgrip" Flexible Belt Lacing

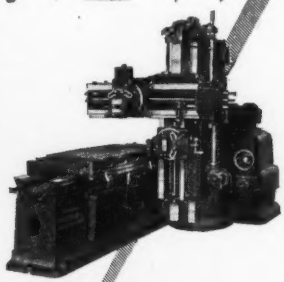
A complete line of flexible belt lacing, called by the trade name of "Steelgrip."



"Steelgrip" Flexible Belt Lacing

has been placed on the market by Armstrong-Bray & Company, 28 North Clinton Street, Chicago, Ill. The lacing is made of selected, heat treated steel of

NEW



*The ROCKFORD  
HYDRAULIC  
Shaper Planer*

### Easy to Operate

**B**ECAUSE of its all-hydraulic construction and centralized sensitive controls, the new Shaper-Planer is extremely easy to operate. There is power rapid traverse in either direction for rail-head and counter-balanced rail. Any table speed between maximum and minimum, and any of the 20 horizontal or vertical feeds, is available instantly.

Specifications, features of construction and their advantages, are described in detail in the folder illustrated above—write for your copy today.

**ROCKFORD MACHINE  
TOOL COMPANY**  
2414 Kishwaukee St.  
ROCKFORD, ILLINOIS, U.S.A.

## Grind Your Taps Properly - - -



**D**O YOU want clean, sharp, accurate threads in your tapped holes—or is any kind of thread good enough? Accurate threads can only be obtained from properly ground taps—taps with all flutes ground exactly alike. The Grand Rapids Tap Grinder is the ideal machine for this work. With it, you can properly grind practically any right or left-hand tap in less time than by any other method. Let us prove to you the value of this machine in your shop—send the coupon NOW!

**GALLMEYER & LIVINGSTON CO.**  
348 Straight Ave., GRAND RAPIDS, MICH.

GALLMEYER & LIVINGSTON, M130  
Grand Rapids, Michigan.

How valuable will the Grand Rapids Tap Grinder be in my shop?

Name .....  
Firm .....  
Address .....  
City.....State.....

## CONNECTICUT BROACHES

*for better  
RESULTS!*



When you use a Connecticut combination round and spline broach you are assured of great savings in time, reductions in tool costs, and a more accurate job. These results are positive because this tool broaches the drilled hole to size, cuts the splines and removes the burrs in one operation.

You cannot afford to overlook these possibilities in your plant. Send us a description of your work and we'll recommend a broach that is guaranteed to give you better results!

**The CONNECTICUT  
BROACH & MACHINE CO.**  
NEW LONDON, CONN.

great toughness and tensile strength, yet it is hard enough so that the points of the lacing will penetrate the toughest belts and will stand the grueling test of long, continuous use. The joint of the lacing is made with a steel rocker pin which is composed of two segments, one rocking against the other and in this manner absorbing at the joint which is caused by traveling around the pulleys. The only tool needed to apply the lacing is a hammer. When installed, it is smooth on both sides. The lacing is especially adapted for conveyor work, on account of its great strength and flexibility.

### Siewek Fixture Lock

The Siewek Tool Co., 10230 Woodward Avenue, Detroit, Michigan, has developed a fixture lock which is easily adapted for use, can be easily operated, and is



Siewek Fixture Lock

positive in operation. The operation of rotating the handle also rotates a cam ring which, in turn, rotates a shaft that is integral with the work-carrying part of the fixture. When the motion of the shaft ceases, due to resistance from the work, further movement of the handle operates to lock the work in the desired position. The work is released by rotating the handle in the opposite direction.

### Thor No. 278 Rotary Pneumatic Wrench

The Independent Pneumatic Tool Co., 236 S. Jefferson St., Chicago, Ill., has designed a new type of pneumatic wrench—the Thor No. 278 Rotary Pneumatic Wrench—which is said to develop more horse power at a high speed than

## EFFICIENCY—DEPENDABILITY

*Both Prime Factors Built in*

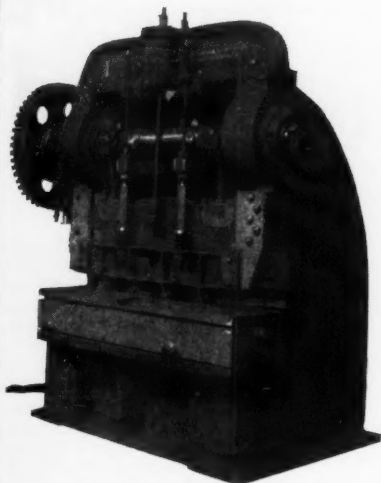
### POWER PUNCHING and SHEARING

*Machinery Made By*

**THE LONG & ALLSTATTER CO.**  
HAMILTON, OHIO

A superior and more complete line than ever, for perforating and cutting off metal in practically any size or shape

**STEEL PRESS BRAKES  
ALLIGATOR SHEARS  
POWER PRESSES**



Gate Shear, Medium Size

## AMERICAN V-2 Broaching Machine

**SMOOTH - POWERFUL  
ACCURATE - PRICED RIGHT**

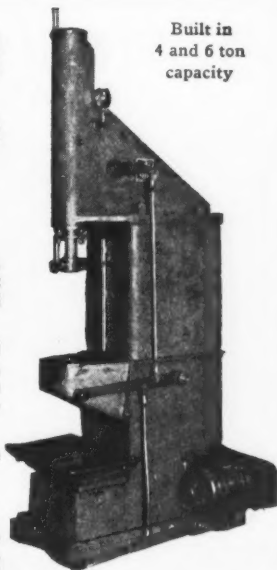
**H**YDRAULIC PRESSURE is smooth acting, positive, and powerful—the ideal for accurate broaching. That is why the American V-2 Broaching Machine is equipped with hydraulic feed.

It gives the ram a steady, smooth, downward stroke, and at a speed of 20 feet per minute has enough reserve power, up to 6 tons, to complete the stroke at this speed. As soon as the stroke is completed the ram automatically returns to the starting position.

This feature and many others are completely described in our bulletin—write for it TODAY!

**The American Broach & Machine Co.**  
ANN ARBOR  
MICHIGAN

Built in  
4 and 6 ton  
capacity



any other wrench made. The wrench has been given severe tests, and in one shop, the hand task of removing stay-bolt caps which formerly took two boilermakers and two helpers eight hours is now done by one boilermaker and helper, using the Thor No. 278 wrench.

The great power of the tool makes it ideal for removing rusted staybolt caps. On the throat sheet where it has always been difficult to get in with a tool, the Thor fits perfectly. Its exceptionally fast starting torque makes it easy for the Thor No. 278 to break nuts loose from cylinder studs without backing the studs out. The speed of the wrench is controlled by a governor, and heavy duty ball bearings are used at all vital points. A renewable rotor liner saves the cylinder from excessive wear and

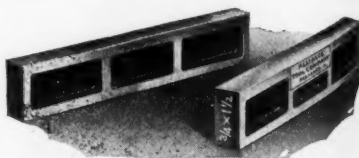


Thor No. 278 Rotary Pneumatic Wrench

reduces upkeep costs. The speed of the wrench is 170 r.p.m. The weight is 40 pounds.

## Alliance Ribbed Parallels

The Alliance Tool Company, Alliance, Ohio, has developed a line of parallels which are strong, accurate, and light.

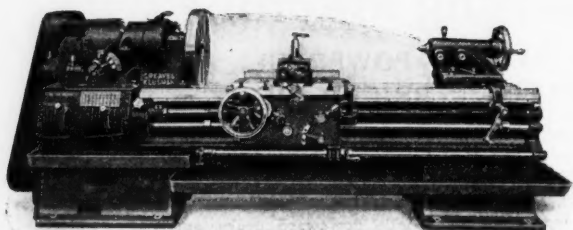


Alliance Ribbed Parallels

The parallels are of special composition malleable iron, seasoned and treated to hold their shape and accuracy. Substantial ribs provide for strength and lightness, and accuracy is provided by grinding to within .005 inch limits. The parallels can be obtained singly, in pairs, or by the complete set, sets being supplied in sub-

stantial wood cabinets without extra charge. The parallels are available in sizes from  $\frac{3}{8}$  x  $\frac{3}{4}$  x 6 to  $1\frac{1}{2}$  x 3 x 6 inches.

## G-K SINGLE LEVER CONTROL MEANS LOWER COSTS!



Eliminating waste motion and idle machine time is one way to reduce machining costs. This is exactly what the G. K. Single Lever control lathe will accomplish in your shop. With this tool, any speed of an extremely wide range can be instantly selected through a single lever. To make it more

convenient, a chart tells at a glance how to obtain the desired speed.

This, and many other features of particular interest to production men are fully described in the G. K. Catalog—be sure you get a copy!

**The GREAVES-KLUSMAN TOOL CO., Cincinnati, O.**



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Alliance,  
parallel  
and light



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# the Chuck That Stops Tap Breakage

**NOT** made, did we hear you say?  
Don't fool yourself. Here's one  
and it does just that—**STOPS TAP  
BREAKAGE.** It's

## THE APEX FRICTION

Many of the largest firms in the country use them—lots of them. Hundreds of smaller shops will use no other kind. "Not a single broken tap in 6 months"—a common boast of those "in the know."

Those working alloy steels, blind holes and with tough tapping to do rarely ever break a tap—or strip threads when tapping soft metals. When used with Apex free-floating collets, the taps follow the holes better, tap more accurately and tap much faster.

The very thing when used with air or electric tools for stud and nut setting because they slip at the right point.

Get an Apex Friction Chuck. Find out for yourself. Send it back, if not all we say it is.

**ALSO** floating tool holders,  
multiple spindle tapping chucks,  
universal joints, universal joint  
nut setters, stud setters, quick-  
change drill chucks, floating  
tap sleeves, etc. We guarantee  
them all.

# APEX

**THE APEX MACHINE CO.**  
302 Davis Ave., DAYTON, O.



## Where only a Starrett will do

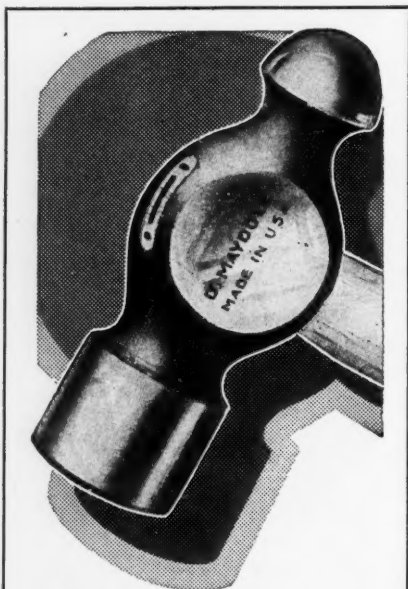
**THE** cut-away frame of this Starrett Mike No. 230 gets it into places where an ordinary mike can't go. Like other Starrett Tools, it gives your men unfailing accuracy, as a matter of course; and it offers a feature of design that makes it a little more useful. That's why your men prefer Starrett Tools.

Write for the Starrett Catalog No. 24 "MD." It illustrates and describes all the Starrett Micrometers and over 2,500 other Starrett Tools.

**THE L. S. STARRETT CO.**  
World's Greatest Toolmakers  
Manufacturers of Hacksaws Unexcelled  
Steel Tapes — Standard for Accuracy  
ATHOL, MASS., U. S. A.

Golden  
Anniversary of  
Starrett Tools  
1880-1930

## Use Starrett Tools



## A hammer for skilled machinists

**B**ALANCED as carefully as a watch — heads press-forged from high grade tool steel, each tempered separately — clear, second growth hickory handles air dried for years and put into the heads "for good" — Maydole Hammers are built for men who know tools and like to work with good ones.

Once you've used a Maydole, you'll never be satisfied with any other. Your dealer carries them.

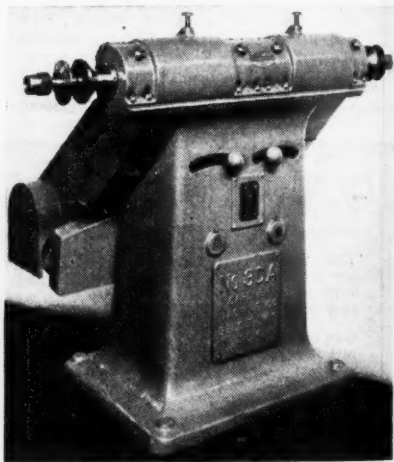
Write us for a free copy of Pocket Handbook 23 "P" containing much useful information.

YOUR HAMMER SINCE 1843  
**Maydole**  
**Hammers**

The David Maydole Hammer Co., Norwich, N.Y.

## Gardner No. 3-DA Double Spindle "Speed-U-Need" Polishing Lathe

The Gardner Machine Co., 423 E. Gardner St., Beloit, Wis., has brought out a double spindle polishing lathe in which are embodied the usual advantages of a two-spindle machine, plus the advantages resulting from the use of the V-type multiple-belt drive. Each end of the machine can be operated independent of the other, due to the fact that two spindles are used, each carrying a multiple-groove sheave. A motor having a double shaft extension is mounted on a sliding bracket at the rear of the base, carrying a sheave on each end of the shaft. The sheaves run idle on the motor shaft and are driven through a friction clutch mounted on the outer end of the shaft. The clutch shifters are operated through a totally-



Gardner No. 3-DA Double Spindle Polishing Lathe

enclosed linkage, terminating in handles conveniently located at the front of the base.

Any desired spindle speed may be obtained by using motor and spindle sheaves of the proper diameter. The two spindle ends may be operated at different speeds by equipping the motor shaft with sheaves of different diameters. The V-type multiple belts which drive the spindles are positive and slip-

# LET A POWELL BLOW GUN AIR VALVE-

*Blow your Turnings or Borings away*

# BLO-GUN



AN INTERCHANGEABLE  
NOZZLE TIP FOR EVERY PURPOSE-



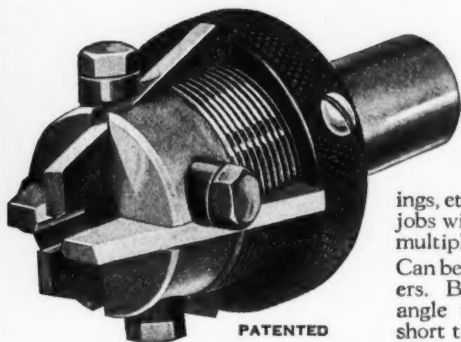
# POWELL VALVES



THE WM. POWELL CO., Cincinnati, Ohio

## Genesee Adjustable Hollow Mill

Made in 7 different styles



PATENTED

A Genesee Adjustable Hollow Mill can be made for every job

WRITE FOR CATALOGUE

## GENESEE MANUFACTURING CO., Inc.

ROCHESTER, NEW YORK

Has adjustable, replaceable blades and can be replaced at nominal cost, making it unnecessary to continually buy new tools.

The ideal tool for finishing your forgings, castings, etc. Do your several operation jobs with Genesee inserted blades multiple operation tools.

Can be fitted with drills and reamers. Blades can be ground any angle to point work and turn short tapers.

## "Don't throw away those old cutters!"



"Don't throw away those old cutters, Jim. We can have them recut by the National Tool Salvage Method and save from 20% to 60% on our tool costs."

"Sounds fine, John, but will they be any good?"

"Don't you worry about that, Jim. The teeth are recut and the clearance restored by this method without impairing the quality or temper of the steel. The fact is, each recut tool is guaranteed to be as efficient as any new tool."

Thus scores of concerns have reduced their tool costs. You can prove the merit of this method to your own satisfaction. Just send us a trial order, and test the reclaimed cutter in your own shop! We'll pay the transportation one way.



3840 Beaubien St. DETROIT, MICH.

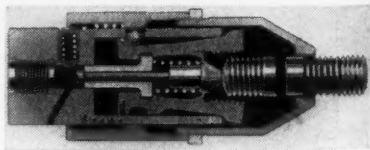
less, simple, efficient and silent. All belt strain is removed from the bearings, as this type of belt can be run comparatively slack. Adjustment for varying belt lengths is provided, and in case of breakage, replacement can be made in a few minutes and without disturbing the bearing mounting on the spindle. Belts and sheaves are completely enclosed.

The spindles are large, with  $2\frac{1}{4}$ -in. bearings and a  $1\frac{1}{4}$ -in. diameter arbor. A double-row Timken adjustable bearing is used in each end of the spindle units, each of which is mounted in a dust proof cartridge housing which is carried directly in the base casting. Each entire spindle assembly can be removed from the machine as a unit. The semi-projecting type of base, giving a slight overhang of the spindle, provides ample clearance across the front of the machine for long work. Spindle locks are placed near the center of the machine, where they are accessible, yet out of the way.

The 5-h. p. motor regularly furnished with this machine is of the enclosed, fan-cooled, ball bearing type, with adjustment for varying belt lengths. It can be furnished in  $7\frac{1}{2}$  and 10 h. p. sizes if desired. Height to center of spindle, 39 in. Area of base on floor, 30 x 25 in. Net weight with motor, 1,225 pounds.

### Titan Quick Release Stud Setter

A self-opening stud setter, for use with power units of any type, has been placed on the market by the Titan Tool Co., Holland and 26th St., Erie, Pa. The tool can be operated with drill presses of any size or type, or with either air or electric drills. It operates as a posi-



Titan Quick Release Stud Setter

tive drive, the drive releasing automatically when the stud has been driven in so that it projects to a predetermined height. The studs are not burred in driving.

In operation, the tool may be clamped onto studs that have previously been

# Nielsen Live Centers

## Stand the "GAFF"!



THE stamina of NIELSEN Live Centers has been proven in a recent demonstration of tungsten carbide cutting tools at the Case School of Applied Science.

A standard No. 6 NIELSEN Live Center was placed on a turret lathe equipped with a tungsten carbide cutting tool. A cut  $\frac{5}{8}$ " deep with a feed of .037" per revolution was taken in cast iron at a cutting speed of 500 surface feet per minute.

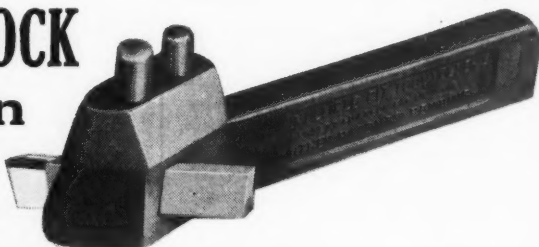
Next steel with an analysis of .50 carbon, .75 chrome and  $1\frac{1}{2}\%$  nickel was turned. A cut  $\frac{1}{4}$ " deep with .037 feed per revolution was taken at a cutting speed of 200 feet

per minute. The center stood up under this cutting load without chatter and showed no sign of breaking down or burning.

There is a NIELSEN Live Center for every center requirement—write for bulletin.

≡ ( **NIELSEN, INC.** ) ≡  
**LAWTON, MICHIGAN**

## WEDGE LOCK Tungsten Carbide Tool Holder



Tungsten Carbide Tools must be supported by a shank of sufficient depth to make the tool rigid. The rectangular slot type (Wedge Lock Tool Holder) is designed to meet this need, since double depth shanks may be used.

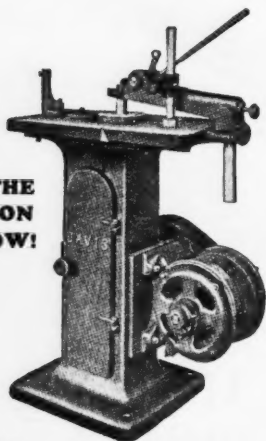
When not used on Tungsten Carbide, use as regular tool holder—it saves time—it uses multiple bits—it's a money-making tool in any shop.

ASK YOUR JOBBER, OR ADDRESS

**WEDGE-LOCK TOOL COMPANY**  
2521 NORTH KEELER AVE. CHICAGO, ILLINOIS

# Have You Investigated

MAIL THE  
COUPON  
NOW!



## The Davis Keyseater

WHILE the Davis Keyseater can be profitably employed on quantity production for a standard part, two minutes is all the time required to change over for each item of a run of mixed work. Its capacity is from 1/16 inch to 1 inch, and cuts tapered or straight Keyways with equal efficiency.

The Davis "Two-Minute-Set-Up" means maximum production. Investigate this method now!

**DAVIS KEYSEATER CO.**  
250 MILL STREET, ROCHESTER, N. Y.

I am interested in the Davis Keyseater.  
Send me Complete Catalog

Name.....Title.....

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Address.....

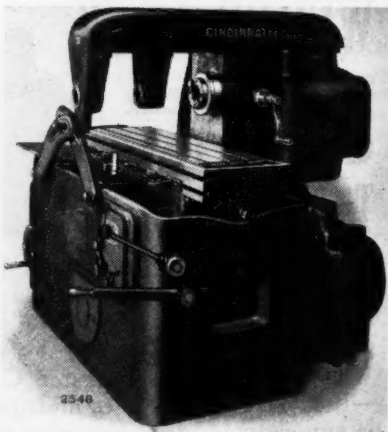
M. M. S. 1

started by hand, or studs may be inserted into the tool for driving into their seats. The positive drive is released when the gage sleeve pushes back the slip ring, which in turn releases the hardened steel driving balls. These balls move outwardly into a recess provided in the slip ring. At this stage the driving jaws remain in complete register with the stud and to further complete the cycle of operation, it is only necessary to lift or pull away from the stud. This is done with complete freedom from driving force, thereby insuring the studs against mutilated threads. As the tool frees from the stud, the slip ring acts on the driving balls, forcing them into a driving position. The jaws open and the tool is ready for the next stud.

The jaws are arranged so that they will fit closely over a stud even though it may vary as much as 0.15 inch in pitch diameter. Studs as short as 1/2-in. may be handled with this tool. It is made in two sizes, maximum capacities 1/2-in. and 3/8-in. studs.

## Cincinnati 3-24 Hydromatic Milling Machine

The Cincinnati Milling Machine Company, Cincinnati, Ohio, has added a



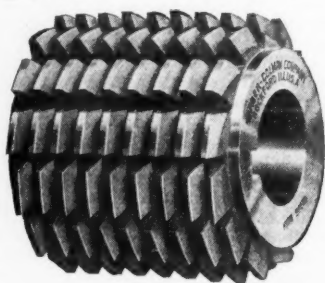
Cincinnati 3-24 Hydromatic Milling Machine

Plain and Duplex enclosed motor-drive Hydromatic to its line of Hydromatic milling machines with locked hydraulic



SERVICE  
*Is Our Motto*

QUALITY  
*Our Creed*



GEAR HOBS

*and*

"BETTER CUTTERS"



*by*

BARBER-  
COLMAN

*of*

ROCKFORD

THESE Small Tools are built for long hours of steady use... to stand the battering of a heavy feed and emerge triumphant... to hew steadily to the limit line beneath a chattering mountain of chips... Quality to the core... strength and sturdiness ever dependable.

BARBER-COLMAN  
COMPANY

General Offices and Plant—Rockford, Ill., U. S. A.

## BIG BOY KEYSEATER

THERE IS NO  
MAXIMUM SIZE.  
THE BIGGER  
THEY ARE THE  
BETTER THEY  
WORK.



These Keyseaters are used commercially daily and our customers naturally appreciate the results obtained. There is no job too big for these tools. The other day we made a Keyseater for a 7½-in. diameter hole to mill an internal keyseat 2½ in. wide by 1 in. deep, 6 in. long in cast iron drums. The job was handled very nicely in a horizontal boring mill. We have made Keyseating Millers for extra long length holes as long as 24 in. to be keyseated. All sorts of lengths and diameters have been met. If you are interested, write for

*Catalog Q*

National Machine Tool Co.

2271 Spring Grove Avenue

CINCINNATI, OHIO, U. S. A.

table feed, thus bringing to users of high production millers a size of machine which is applicable to a large percentage of the work falling within this class. The principal units of the machine, which is known as the No. 3-24, are the standard No. 3 bed table unit with 24-in. table travel, standard No. 3 headstock unit, standard No. 3 spindle carrier with overarm and two arbor supports, spindle reverse and clutch unit, and the hydraulic feed unit located at the rear of the fixed bed. The machine is built on the Cincinnati plan of standard unit construction, which makes it possible to supply it with widened and raised headstock, close-coupled spindle carrier, variable height overhung rail, and bridge-type fixed rail, to meet the requirements of the user.

The work table with unusually long bearings, spindle carrier unit, Cincinnati rectangular overarm, double mounting of anti-friction bearings both front and rear, locked hydraulic feed unit, and automatic control of all table movements are standard Cincinnati features. Any desired feed from 0 to 40 in. per minute are obtainable. Automatic variable feed to suit a varying

width or depth of cut is obtained thru the use of the variable feed attachment, fastened to the bed to the right of the hydraulic feed unit, this attachment being supplied on special order.

All operating levers are conveniently located at the normal operating position. The lower lever, known as the spindle drive starting lever, is used for starting and stopping the spindle. A second lever, just above it, has four positions. The nature of these positions depends upon whether the machine is one-way or two-way cycle, the one-way cycle machine having feed in one direction and quick traverse in two directions, and the two-way cycle machine having two positions for feed and two for power quick traverse. A third lever, located at the side of the bed, starts and stops the table movement without affecting the table cycle. Reversal time of any milling cycle has been considerably reduced, permitting faster production, and a large variety of cycles can be obtained. One-way cycle machines only have automatic spindle stop for stopping the cutter and spindle at the completion of the cut just before the rapid return of the table.

## ❖ A PAIR OF ACES ❖



**USE Union All-Steel Independent Chucks** where strength to withstand heavy duty performance is required for a modern lathe.

Body of cast steel—three times as strong as iron with extra heavy jaws, made of special steel, with raised ground steps. Large chrome-nickel operating screws have heavy square threads with a bearing on each end. Designed in proportion to the strength of shell.

**Write for Catalog.**

New York  
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No. 123—STEEL BODY  
No. 153—IRON BODY

**SHOP MEN** prefer a strong one-piece shell as used on **UNION Geared Scroll Chucks** because they will not break under sudden strains.

Jaws, scroll, and pinion are made of Alloy steel and hardened. Jaws are ground true and tested for accuracy. Reversible top jaws also furnished if desired.

**Ask Your Dealer or Write Us For Catalog.**

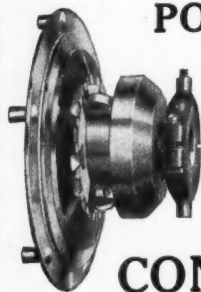
**UNION MFG. CO.**

**NEW BRITAIN**

**CONNECTICUT**

Cincinnati  
San Francisco

## THE TALKING POINT



For  
1930

Will Be

## CONWAY DISC CLUTCH CONTROL

The Conway Disc Clutch is a product of a company which has never, since its establishment in 1904, manufactured anything else.

The skill, experience, and knowledge of starting and stopping acquired by our engineers and shop personnel are a priceless heritage to the user of friction clutches.

And the Conway Disc Clutch—with easy engagement, instant release, drag-free idling and power plus—with enclosure, balance, centripetal action, under-slung levers, and "no tool" adjustment—

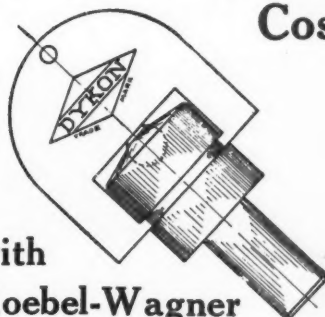
"Is the last word in friction clutches."

*The Conway Disc Clutch is patented. All infringements will be prosecuted.*

## THE CONWAY CLUTCH COMPANY

1545 QUEEN CITY AVE.  
CINCINNATI, OHIO

## Cut your Grinding Costs



with  
Koebel-Wagner  
**DIAMONDS!**

**A**RE your precision grinding wheels doing precision work . . . or, are they dull and unevenly worn? The point is that unless you keep them true and smooth, precision work cannot be obtained at reasonable costs!

Koebel-Wagner Diamonds will true your wheels better—quicker—and with less waste. Each diamond is set in a Safety-Mounting which securely holds the stone in place and prevents loss. These diamonds are protected against abuse by the "Dykon" Gage. This is a small Koebel-Wagner Device which indicates at once when the diamond is worn to its lowest level and requires resetting.

Scores of leading manufacturers throughout the country have found that the use of Koebel-Wagner diamonds lowers their grinding costs and gives better results. These diamonds will lower your costs as well . . . let us show you how . . . send the coupon TODAY!

## Koebel-Wagner Diamond Corp.

144 ORANGE ST.

NEWARK, N. J.

Koebel-Wagner Diamond Corp.,  
144 Orange St., Newark, N. J.

Show me how I can cut my grinding costs with Koebel-Wagner Diamonds.

Name .....

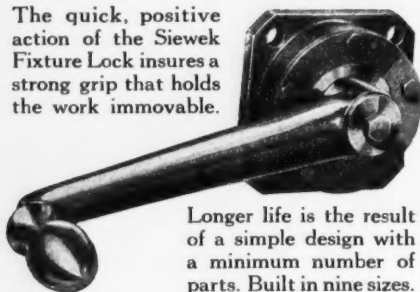
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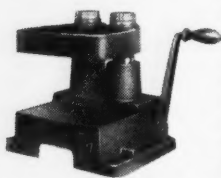
## Siewek Fixture Locks

The quick, positive action of the Siewek Fixture Lock insures a strong grip that holds the work immovable.



Longer life is the result of a simple design with a minimum number of parts. Built in nine sizes.

## Siewek Drill Jigs

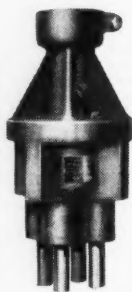


The *Cushion Clamping* of Siewek Drill Jigs conserves energy, allows closer drilling accuracy, reduces loading time, and increases production. These jigs have large

wearing surfaces to withstand hard usage and to maintain their accuracy. It is built in eight types.

## Siewek Drill Heads

Siewek Drill Heads, when used in combination with Siewek Drill Jigs, insure a tool set-up that will give maximum production over a long period of time. There is a Siewek Drill Head to meet every requirement.



Write For Catalog

# Siewek Tool Co.

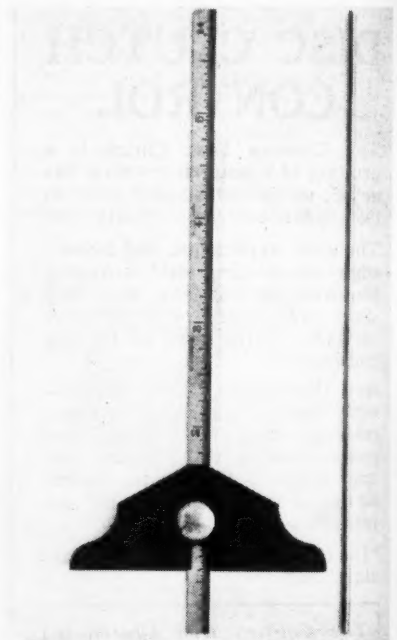
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Coolant and lubrication systems are the standard "Cincinnati" types. The overall working table dimension is 49 x 12 in. with a travel of 24 in. Net weight, plain machine, 5,500 lbs., duplex, 6,500 lbs. These same machines can be supplied with 30-in. table travel if desired, and are then known as No. 3-30. Net weight, 3-30 plain, 7,500 lbs., 3-30 duplex, 9,000 pounds.

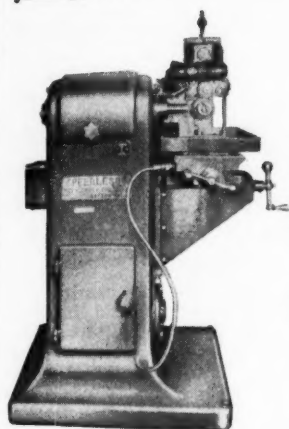
## B. & S. No. 617 Drill Point Gage and Depth Gage

The tool shown in the illustration—a product of The Brown & Sharpe Mfg. Co., Providence, R. I.—is a combination



B. & S. No. 617 Drill Point and Depth Gage

of two tools in one. It can be used for checking the points of drill gages, when grinding them, to determine whether or not the point is central, or it may be used as a depth gage for finding the depths of holes as small as  $\frac{1}{8}$ -in. in diameter. The graduated bevels on the head are ground to 59 degrees. The 6-in. rule which forms a



## THE AIR EQUIPPED **PEERLESS** CHAMFERING MACHINE

will cut a rounded ball point, a straight 45 degree chamfer, or any other chamfer or roundness with equal ease.

It is equipped with air cylinder to eliminate the slow hand method of mounting the work and will increase production 20 per cent to 30 per cent.

No user of tooth chamfering equipment can afford to overlook the Flexibility of the Peerless Tooth Chamfering Machine. Send for circular.

## CITY MACHINE & TOOL WORKS

5 North June St.



DAYTON, OHIO

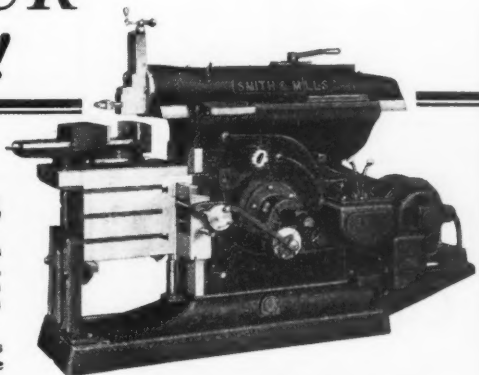
## CUT YOUR COSTS!

### SMITH & MILLS HIGH SPEED CRANK SHAPERS

are designed for accurate work at high speeds. They shorten production time, which cuts your operating costs. Smith & Mills shapers are equally efficient on tool room or production work.

Smith & Mills modern improvements include "V" type ram with 55 degree ways, splined shafts, heat-treated alloy steel gears, speed box shafts mounted on Timken tapered roller bearings, Twin Disc Clutch, and one shot lubrication system.

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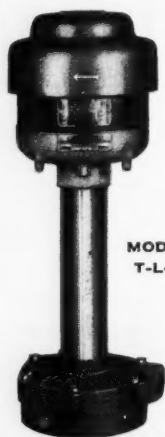


Made in 16, 20, 25 and 32-inch sizes  
back geared; single-gear in 12  
and 14-inch stroke.

**THE SMITH & MILLS CO., Cincinnati, Ohio**

*During 1930*  
**ECONOMIZE**  
*on production!*

Decrease your production costs by increasing the efficiency of your machines. Equip them all with . . .



MODEL  
T-L-O

**"GUSHER"**  
**Coolant Pumps**

*Write for Information*

**The Ruthman Machinery Co.**  
 532 East Front Street  
 CINCINNATI, O.

part of the gage is graduated in 32nds and 64ths of an inch. A 6-in. rod, 5/8 in. in diameter, for use in small holes can also be furnished. The tool has a range up to 5 inches, or can be furnished in equivalent length, graduated for Metric measure, if desired.

**Johnson Bronze Company De-velops Self-Lubricating Bearing**

A self-lubricating bronze bearing, said to be the only one of its kind, has been announced by Johnson Bronze Company, New Castle, Pa. The bearing is intended to provide for a uniform area of bearing surface on the pressure line, and insures an efficient distribution of lubricating compound. The compound used is also a Johnson Bronze development.

The results referred to are obtained by a new method of effecting indentations in the metal and by placing them on an angle of 30 degrees. Patent covering this method has been applied for. According to the manufacturer, these indentations form effective receptacles for the lubricating compound and thus provide for the high efficiency of the bearing. The bearing is especially adaptable for use in machines and parts that are subject to intermittent or periodical operation, such as brake levers, shock absorbers, rocker arms, starting motors, guide rollers, and so on.

**Vapor Bath for Degreasing of Metals**

A new vapor bath process for the degreasing of metals and other impervious materials has been developed by the Carrier Engineering Corporation, 852 Frelinghuysen Ave., Newark, N. J. In this process a solvent known by the trade name of Cecolene is boiled and vaporized. The objects to be degreased are hung in the vapor, which condenses on the surfaces of the objects and runs off, carrying with it all the grease. The objects are kept in the vapor until the surfaces heat to the temperature of the vapor, which takes from 1½ to 3 minutes, depending upon the materials. They are then removed in a clean, warm and perfectly dry state, any foreign matter remaining being in the form of dust which is easily removable.

In the standard form of apparatus used the vapor rises to the level of



# Stuart Oils

FOR THE "TOUGHEST"  
METAL WORKING CONDITIONS

The RIGHT Oil

For GUN  
DRILLING

**Stuart's**

**Thred-Kut**

Alloy Steel Cutting Oil

FOR all kinds of deep-drilling, the use of STUART'S "THRED-KUT" OIL will disclose new standards of efficiency in respect to the securing of smoother finish and longer life of expensive tools.

STUART'S "THRED-KUT" has become the most highly recommended cutting oil in America for all tough work. Order trial drum from nearest office and warehouse on basis of 100% satisfaction or 100% credit.

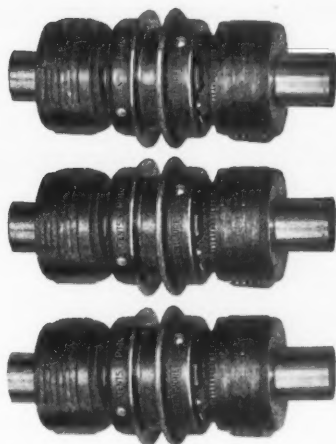
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Warehouses in Principal Centers



## The PULLMORE Industrial Clutch

EFFICIENT  
COMPACT :: ADAPTABLE

### SEND COUPON

In addition to sending you full descriptive matter on this new and most efficient clutch, if you will send us details of any installation you may have in mind, our engineering department will be glad to submit their recommendations applying directly thereto, gratis.

**Rockford Drilling Machine Co.**

10 Catherine Street  
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**ROCKFORD DRILLING  
MACHINE CO.**

Rockford, Ill.

Send me a copy of the PULL-  
MORE Industrial CLUTCH cata-  
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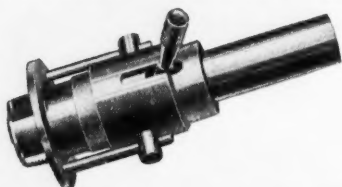
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MMS-1

# TAP

*Without Reversing!*



**M**URCHEY Collapsible Taps and Self-Opening Die Heads require no reversing. All the time, power, and strain in reversing is eliminated. When the work strikes the face of the trip ring, the chasers recede, allowing the tool to be withdrawn instantly.

The Murchey tool illustrated is a standard lever handle collapsible tap. This tool is used on machines having stationary spindles. There is also a model for revolving spindles.

There are forty-six sizes of collapsible taps and fifty-five sizes of self-opening die heads to meet your requirements. Send for a catalog.

**MURCHEY  
MACHINE & TOOL CO.**

951 PORTER STREET  
DETROIT MICHIGAN

water-cooled condenser coils around the sides near the top of the tank, where it condenses and is precipitated to the bottom of the tank. As the vapor is more than three times as dense as air, there is no tendency to overflow or escape. The objects being degreased do not come in contact with grease previously removed from other materials, as the solvent vaporizes at a temperature much lower than the grease, which remains in the liquid below. The chlorinated solvent can be used over and over, the vapor being always clean.

The vapor degreaser is to be made in standard dip tank units, also in special designs adaptable to any style of continuous conveyor in line assemblies, and for steam, gas or electric heating. Celcolene is a blanket term for a group of solvents adaptable to various uses and materials, and the Carrier Company is prepared to supply any needed variation of the formula for a special case.

## Handy Andy Hoist

The Handy Hoist Company, 847 West 120th Street, Chicago, Ill., has now placed on the market a low head room



Handy Andy Hoist



### 15 Milling Operations at One Set-Up

—and 15 is not the limit to the number of milling operations possible at one set-up of the Porter-Cable milling attachment shown above.

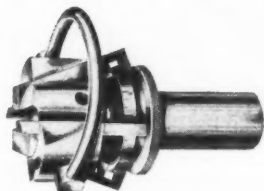
Capable of operating at any angle in any plane, it can assume an infinite number of positions to conform to the work, saving enormously in set-ups. Attachable to any standard miller, hand or power feed, it can be slipped on or off in three minutes. Any of five models, from the high speed, sensitive belt driven model to the heavy duty gear driven, soon save their cost in fewer set-ups, and increased capacity of the miller.

*Details On Request*

**The Porter-Cable Machine Co.**  
300 Wolf Street Syracuse, N. Y.

Ⓔ4201

### Adjustable Hollow-Mill High-Speed Blades



All blades adjusted to size by graduated collar and clamped instantly with ring lever. Shanks removable for different sizes.

**OGDEN R. ADAMS**  
407 Cutler Bldg., Rochester, N. Y.

## Lower Costs and Improved Quality

ARE INSURED BY THE USE OF

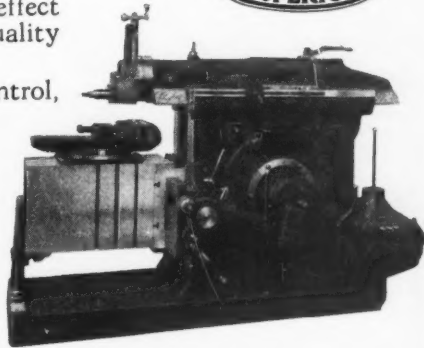
## COLUMBIA SHAPERS!



These modern, complete machines effect noteworthy improvement in both quality and quantity of output.

Features such as centralized control, cross rail locked by one lever, longer stroke on angular cuts, patented quick-change feed, extra large table with improved outer support, selective speed box with hardened alloy-steel gears, flood lubrication, etc., provide maximum speed, ease and convenience in operation.

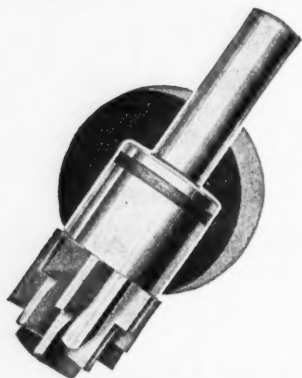
*Full details in bulletin No. 17, free on application. Send for your copy today.*



**THE COLUMBIA MACHINE TOOL CO.**  
HAMILTON, OHIO

# Eclipse

## TOOLS CUT YOUR OPERATING COSTS!



**ECLIPSE TOOLS** are saving thousands of dollars for their users by eliminating obsolete methods, reducing labor costs, and increasing production.

For example—

The ECLIPSE eight operation cutter illustrated eliminated several operations, one \$2,250 machine, five cutters, the labor cost of one man, and cut the former production time in half.

This is just one of the many ECLIPSE High Production Tools which are described in the ECLIPSE Catalog. Send the coupon now for your copy.

**ECLIPSE COUNTERBORE CO.**  
**DETROIT MICH.**

ECLIPSE COUNTERBORE CO.,  
Detroit, Mich.

Please send your Catalog No. 28 to

Name .....

Firm .....

Address .....

City..... State.....

electric hoist, under the trade name of "Handy Andy."

The "Handy Andy" is a simple, compact hoist having a total weight of only 160 pounds, 24 inches in length, and 7½ inches in diameter, with lifting capacities of 500, 1,000 and 1,500 pounds. It is a fully enclosed unit, all working mechanism being encased in a heavy cast frame or housing. However, the entire gear mechanism, as well as the drum type switch, may be easily taken out by removing the end plate. The motor also may be easily removed without disturbing the wiring.

The gears are of the best steel—properly cut and heat treated. All shafts are machined and ground to close limits, and all parts are interchangeable. The drive shaft, pinion and motor shaft are integral, eliminating play and friction. The main shaft runs on ball bearings, and there is a complete self-lubricating system with oil reservoirs over each bearing. A fan for cooling the motor is also mounted on the shaft.

The Hoist is equipped with 110 volt, universal A. C. or D. C. motor, with cord and plug for operation from any lamp socket. Standard equipment also includes a 12-foot length of load chain with hook at one end. Positive mechanical load control is provided, the brake engaging at the same time the switch is thrown into neutral, thereby preventing either coasting or slipping of the load.

Automobiles have taken first rank among the exports from the United States. During the first six months of 1929, the value of automobile exports totaled \$354,874,924—a gain of 36.4 per cent over the previous year.

### Fixture for Machining Eccentric Crank Arms

(Continued from page 66)

an attachment which is used with the Morton drawcut shaper for machining driving box brasses, the worm drive being utilized to revolve the crank arms. The other end of the mandrel revolves in a bearing. The angle plate is used to give stability to the set-up. The radii on both ends of the cranks and all edges were machined with the set-up shown.

January

Bu

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## Bulletin On "Labor Saving Hoppers"

A bulletin describing and illustrating the use of labor-saving hoppers with Cincinnati Centerless Grinders has been issued by Cincinnati Grinders, Incorporated, Cincinnati, Ohio. Applications of the hopper for handling either thru-feed or in-feed operations are shown and descriptions of the different kinds of work that can be handled advantageously by the hopper are included.

## Danly Catalog of Die Makers' Supplies

The Danly Machine Specialties, Inc., Chicago, has just published the sixth edition of its well-known catalog and data book on die sets and die makers' supplies. This edition has been completely revised to include the complete line of reverse die sets manufactured by this company, together with additional sizes of laps, stripper bolts and bushings. A new type of shoulder, guide post or leader pin and bushing has been included. In the same cover is included a 12-page book on "Large Die Sets," covering the new line of 4-post and 2-post rectangular, 4-post square and 3 and 2-post long narrow die sets together with special heavy duty guide posts and bushings.

A chart of exceptional value in this 12-page book shows the various sizes and makes of punch presses which may be employed for the different sizes of large die sets. When the die space required has been decided upon, the smallest press that may be used can be immediately determined from this chart. Address Danly Machine Specialties, Inc., 2122 South 52nd Avenue, Chicago, Illinois.



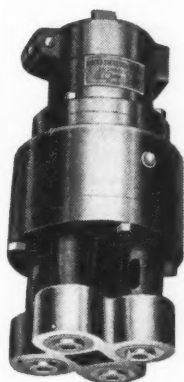
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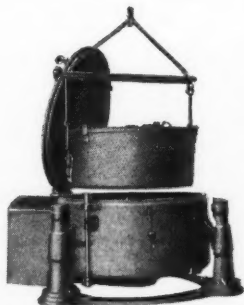
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## Check For Information Wanted

If you are interested in prices or information on any of the equipment listed, check the item, write your name, firm name, title and address on the margin, tear out the page and send it to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. We will see that you are supplied with the information desired.

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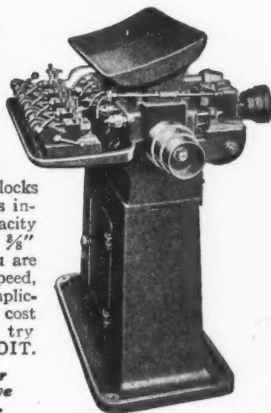
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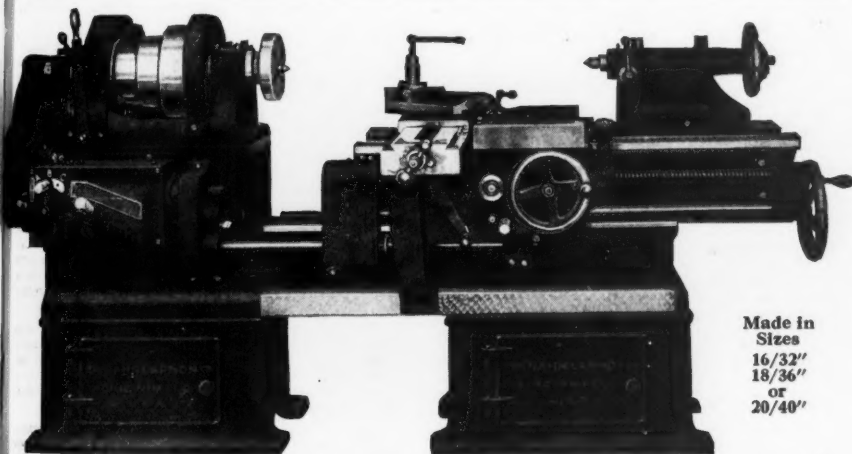
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Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Open Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

**Abrasive Grinding Wheels:** The types of wheels, with recommended grades and grains, which should be used for each of the various kinds of grinds are discussed in a booklet which will be sent free to mechanical executives by the Abrasive Company, Philadelphia, Pa.

**Hollow-Milling:** How production can be increased and costs lowered by the use of adjustable hollow-mills with high speed blades and interchangeable shanks is told in a bulletin that has been issued by Ogden R. Adams, 407 Cutler Bldg., Rochester, N. Y. Copy free upon request.

**Broaching By Modern Methods:** Equipment and tools for finishing round, square or irregular-shaped holes and surfaces by broaching are described and illustrated in a booklet that is issued free by the American Broach & Machine Co., Ann Arbor, Michigan.

**Ames Dial Gages:** The latest types of dial gages for inspection purposes are described in the Ames No. 55 Bulletin, which will be sent free to any machine shop executive. Address B. C. Ames Co., Waltham, Mass.

**Serapng By Power:** Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

**Steel Furniture for the Shop:** The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

**Stop Tap Breakage:** A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine Co., 200 Davis Ave., Dayton, Ohio. Sent free upon request.

**Machine Shop Accessories:** Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

**Metal and Wood Saws:** Catalog No. 20 describing saws of all kinds, for both metal and wood. 256 pages of descriptions of saws and sawing machinery. E. C. Atkins & Co., 402 S. Illinois St., Indianapolis, Ind.

**Hobs and Milling Cutters:** A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

**All-Geared Drilling and Tapping Machines:** A catalog describing in detail the various types of all-geared, self-oiling, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

**Modern Drilling Equipment:** Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

**Automatic Oiled Die Sets:** The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

**"C-V" Chrome Vanadium Wrenches:** A complete line of wrenches made of Chrome Vanadium steel—practically unbreakable—is described in a booklet that has been issued by the Bonney Forge & Tool Works, Allentown, Pa. Copy free upon request.

**Bradford Precision Lathes:** Precision Lathes for the tool room and for general manufacturing purposes, all geared and cone types, belt or motor driven, are described and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

**How to Sharpen Cutters:** A series of leaflets, which describe and illustrate the correct methods to employ in sharpening all kinds of cutters, can be obtained, without charge, by addressing Brown & Sharpe Mfg. Co., Providence, R. I.

**High Speed Drill Presses:** A complete line of drill presses that can be run at high speeds with complete safety is described in catalog number 50, issued by the Canedy-Otto Manufacturing Company, Chicago Heights, Ill. This catalog also contains descriptions of other equipment manufactured by this concern. Sent free upon request.

**Gears Of All Kinds** are described and illustrated with specifications, in Catalog 80, which has been issued by the Chicago Gear Works, 105-9 S. Jefferson St., Chicago, Ill.

**Gear Data:** The Cincinnati Gear Co., Cincinnati, Ohio, has published Catalog D, which describes and illustrates the various types and kinds of gears made by this firm. The book contains photographs of the plant departments, with descriptions of the equipment employed, and also includes a number of pages of valuable data and reference tables for machine shop use.

**Grinding the Centerless Way:** The advantages of the centerless grinding method is discussed in a booklet which also describes the centerless grinding machines made by Cincinnati Grinders, Inc., Cincinnati, Ohio. The illustrations show various types of jobs in process, and full data is included. Copy free upon request.

**Giant Automatics with Hydromatic Feed** is the title of a book that describes in detail the new type of automatic milling machine with hydraulic feed, which has been developed by The Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio. Copy free to any machine shop executive upon request.

**Rapid Traverse Planers:** Cincinnati Hypo Planers, made by the Cincinnati Planer Co., Cincinnati, Ohio, are described in a new catalog that has been issued by this company.

**A Treatise on Shaper Design,** illustrating the features that are to be found in the new Cincinnati Rapid Traverse Shapers and describing the shapers that are made by this firm, will be sent free to any mechanical executive by the Cincinnati Shaper Co., Dept. M.E., Cincinnati, Ohio.

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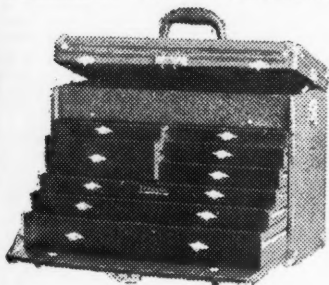
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**Bolender Gear Burnisher:** The latest methods of burnishing gears for accuracy and silence are described in a booklet that has been issued by the City Machine & Tool Works, 5 N. June St., Dayton, Ohio. Copy free upon request.

**Handbook For Drillers:** The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

**Columbia Superior Shapers:** Bulletin No. 17, issued by The Columbia Machine Tool Co., Hamilton, Ohio, describes and illustrates the line of heavy duty shapers made by this firm. Copy free upon request.

**Broaching for Profit:** A combination round and spline broach which broaches the drilled hole to size, cuts the splines, and removes the burrs in one operation is described in a circular which will be sent free by The Connecticut Broach & Machine Co., New London, Conn.

**Die Makers' Supplies:** A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Dandy Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

**Make Better Dies:** Better work can be produced, and in less time, if the die can be held in the most convenient position. A universal die-holding stand which can be quickly adjusted to hold a die at any height or angle is described in a catalog which can be obtained by addressing Davenport Locomotive & Mfg. Corp., Dept. M, Davenport, Iowa.

**Davis Keyseaters:** Recent developments in keyseating methods are discussed in a bulletin that also describes the keyseaters made by the Davis Keyseater Company, 250 Mill St., Rochester, N. Y. Copy free upon request.

**Grinding Wheel Dressers:** All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

**Quantity Drilling:** A semi-automatic multiple spindle drilling machine which is designed to produce the maximum of drilled holes in medium or small parts, is described in a pamphlet that is published by the Detroit Machine Tool Co., 5055 Woodward Ave., Detroit, Michigan. Sent free upon request.

**Interchangeable High Production Tools:** Catalog No. 28, issued free by the Eclipse Counterbore Co., 7410 St. Aubin St., Detroit, Mich., describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

**Precision Measuring Instruments:** The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and other precision measuring instruments marketed by the Federal Products Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

**The Practical Art of Generating** is a booklet which contains a simple and practical analysis of the generating principle, together with numerous examples of commercial applications of this art in industry. Copy can be obtained by addressing The Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

**Silent, Self-Lubricating Gears** for use in all kinds of machines are described in a booklet that can be had upon application to Fibroc Insulation Company, Valparaiso, Indiana.

**Formica Silent Composition Gears:** A booklet telling about the uses and advantages of Formica Silent Sheet Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

**Fosdick Drills:** This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

**"Non-Clog" Coolant Pumps** are described and illustrated in a booklet which has been issued by the Fulflo Specialties Co., Blanchester, Ohio. Copy free upon request.

**The Standard and Special Tools** made by the Gairing Tool Co., 1631 Lafayette Blvd., Detroit, Mich., are described and illustrated in a catalog which will be sent free to any mechanical executive. The descriptions cover Gairing counterbores and countersinks, grinding fixtures, reamer-holders, pilots, reamers, spotfences, and other tools.

**Modern Grinding Equipment:** The complete line of universal tool and cutter grinders, surface grinders, drill grinders, tap grinders, and other grinding machines made by the Galmeyer & Livingston Co., 336 Straight St., S. W. Grand Rapids, Michigan, is described in a series of bulletins that have been issued by this firm. Free upon request.

**Adjustable Blade Cutters:** Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the General Manufacturing Co., 141 N. Water St., Rochester, N. Y.

**Precision Horizontal Boring, Drilling and Milling:** The Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., has issued a series of bulletins describing the various kinds of horizontal boring, drilling and milling operations which may be performed with the machines made by this company. Copy free upon request.

**Graeves-Klusman Lathes:** A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Graeves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

**Grinding, Polishing and Buffing Machines** of the latest types are described and illustrated in a series of bulletins that have been issued by the Hammond Machinery Builders, Kalamazoo, Mich. Copies free upon request.

**Drilling and Grinding Electrically:** Catalog M, showing and describing a variety of modern electric portable drills, grinders, and other tools, including floor grinders and buffers, has been issued by The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, Ohio.

**"Exact" Precision Filing and Sawing Machine:** A filing and sawing machine for use in producing templates, dies and other irregular-shaped parts is described and illustrated in a booklet which is issued free by the Index Machinery Corporation, 49 Central Ave., Cincinnati, Ohio.

**Automatic Tapping:** More than 75 per cent of all drilled holes can be tapped automatically in a machine with automatic dial feed, three speeds, automatic index, and automatic knockout, which is described in a bulletin issued by the Index Machinery Corporation, 49 Central Ave., Cincinnati, Ohio.

**Tool Steel Data:** Practical suggestions as to the best methods of heat treating carbon, oil-hardening, alloy, and carbon tool steels, together with hints on ordering carbon tool steels, are given in a booklet which has been issued by Wm. Jessop & Sons, Inc., 121 Varick St., New York, N. Y. A number of useful tables are included. Copy free upon request.

**Special Mill-Waukee-Mills of Standard Units:** A milling machine of which the base, heads, columns, and other

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## Die Making Machines

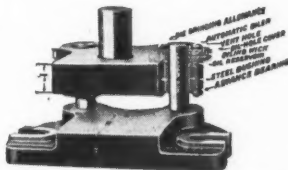
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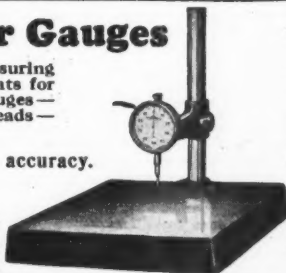
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parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.

**Koebel-Wagner Diamonds for Wheel Dressing:** The Koebel-Wagner method of mounting diamonds and the use of the "Dykon" gage are discussed in a bulletin issued by the Koebel-Wagner Corporation, 144 Orange St., Newark, N. J. Free upon request.

**Cutter and Tool Grinding:** A book that tells how to grind tools and cutters accurately and which also describes and illustrates the different types of LeBlond Universal Tool Room Grinders will be sent free upon request. Address: The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

**Lathe Dogs and C Clamps** are described and illustrated in Catalog No. 80, issued by the W. G. LeCount Tool Works, South Norwalk, Conn. Copy free upon request.

**Air-Operated Work-Holding Devices:** A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

**Punching and Shearing Operations:** A complete line of machines for perforating and cutting metal in practically any size and shape is described and illustrated in a booklet which has been issued by The Long & Allstatter Co., Hamilton, Ohio. Copy free upon request.

**Rapid-Reading Micrometer:** A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

**Maydole Hammers:** All the various types and kinds of hammers made by this 87-year-old firm are described and illustrated in a catalog which can be had without charge. Address The David Maydole Hammer Co., Norwich, N. Y.

**Time Saving Machine Equipment:** How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCroskey equipment is told in a book that is issued by the McCroskey Tool Corporation, Meadville, Penna. Will be sent without charge.

**Hi-Production Counterbores:** A counterbore of simple yet highly efficient construction, with positive drive, rigidity, and a number of other features is described in a circular which will be sent free upon request. Address Morse Counterbore & Tool Co., 12281 Turner Ave., Detroit, Mich.

**Monarch Stud Drivers:** A stud driver that will set a stud tightly and then release easily is described in a circular that will be sent free upon request to Monarch Tool & Mfg. Co., 2704 E. Larned St., Detroit, Mich.

**Automatic Tapping and Threading Tools** of the latest types and designs are illustrated and described in Catalog No. 25, which has been issued by the Murehey Machine & Tool Co., 951 Porter St., Detroit, Mich. Copy free upon request.

**Nates Drilling, Tapping, and Boring Equipment** is the title of a publication that has been issued by The National Automatic Tool Co., Richmond, Ind. The book gives details as to construction and uses of "Nates" multiple drilling and tapping machines.

**Milling Internal Keyways:** A simple method of milling keyways in gears, wheel hubs, and other similar parts with the aid of a drill press and a special tool is explained in a booklet that is published by the National Machine Tool Co., 2271 Spring Grove Ave., Cincinnati, Ohio.

**Double Year Cutter Service:** Milling cutters, reamers and other tools can be recut at a saving of from 50 to 60 per cent by the National Tool Salvage Co., 3849 Beaubien St., Detroit, Mich. Circular upon request.

**Save Time with Expanding Mandrels:** How expanding mandrels will solve the problem of turning pieces with odd-size holes, and will increase production on duplicate work, is told in a folder that will be sent free upon request by W. H. Nicholson & Son, 136 Orange St., Wilkes-Barre, Pa.

**Live Centers:** The complete line of live centers manufactured by Nielsen, Inc., of Lawton, Mich., are fully described in a bulletin issued by this company. The bulletin is illustrated with photographs and blueprints of the Nielsen Center. Mailed free upon request.

**Ball and Roller Bearing Data Sheets:** A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

**Grinding Wheel Information:** A booklet which tells how grinding wheels are made and graded, and which gives instructions for mounting wheels, operating speeds for different kinds of work, instructions for truing and dressing, and other information has been issued by the Norton Company, Worcester, Mass. Sent free upon request.

**Speed Reducers:** Speed Reducers to obtain any desired reduction up to 24,000 to 1 are described and illustrated in Catalog 29-A, issued by The Ohio Gear Co., 1335 East 179th St., Cleveland, O. Copy free upon request.

**Die Making Machines:** How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

**Self-Tapping Sheet Metal Screws:** Screws which are threaded and hardened in such a manner as to enable them to cut their own threads as they are screwed into sheet metal assemblies are described in a folder which is published by the Parker-Kalon Corporation, 192-194 Varick St., New York City, N. Y. Sent free upon request.

**Milling Attachments—both universal and angular,** for performing all kinds of milling operations which cannot be handled with the ordinary milling set-up, are described in a booklet issued by the Porter-Cable Machine Co., 1708 N. Salina St., Syracuse, N. Y. Copy free upon request.

**Tapping Devices, Quick-Change Chucks, Stud-Setting Tools and Bench Tappers:** A catalog describing the various types and kinds of tapping, drilling, and stud-setting devices manufactured by the Proconer Safety Chuck Company, 12 South Clinton Street, Chicago, Ill., can be obtained without charge by addressing this company. The catalog also tells the part that Proconer tools play in obtaining greater accuracy and less tool breakage.

**Engine, Turret, and Gap Lathes** are described in a series of bulletins that have been issued by The Rahr-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

**Pallmore Industrial Clutch:** A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

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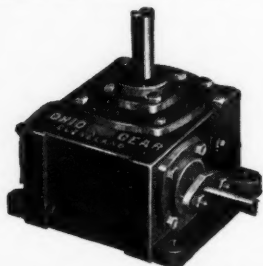


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**Safety Grinding Wheels:** The complete line of grinding wheels made by the Safety Grinding Wheel & Machine Co., Springfield, Ohio, is described in Catalog No. 11, which is issued by this firm. The book also contains instructions for operating grinding wheels, tables of grinding wheel speeds, pulley calculations, and other information for the user of grinding wheels.

**Saving Time With Small Tools:** A line of time-saving small tools, including "Use-'Em-Up" drill sleeve, "Wear-ever" chucks, collets, cutters, reamers and tap holders, counterbores, spotfacers, and other tools is described in Catalog 36, issued by Scully-Jones & Co., 1909 S. Rockwell St., Chicago, Ill.

**Equipment For the Shop:** Vises for the bench, drill press, milling machine or shaper; angle plates; adjustable clamps, jacks and other tools for the machine shop, are described and illustrated in a booklet that is published by the Sheldon Machine Co., 3253-55 Cottage Grove Ave., Chicago, Ill. Copy free upon request.

**Rapid Drill Jigs:** How time can be saved and drilling operations made easier by the use of a quick-acting drill jig is told in a booklet that is issued free by the Slevick Tool & Die Co., 10230 Woodward Ave., Detroit, Michigan.

**"Metal Cutting"** is the title of the book that describes the latest methods of cutting metals, and includes descriptions and illustrations of both the band saws and inserted-tooth metal-cutting saws made by the Simonds Saws & Steel Co., Fitchburg, Mass. Copy will be sent free upon application to the firm mentioned.

**Shaping with Modern Equipment:** The Smith & Mills Company, 2889-91 Spring Grove Avenue, Cincinnati, Ohio, has issued a booklet which describes and illustrates the line of modern shaping equipment made by this firm. Copy free upon request.

**Machinists' Tools and Gages:** Catalog No. 24, issued by the L. S. Starrett Co., Athol, Mass., describes and illustrates the complete assortment of machinists' fine tools and gages made by this firm. Copy free upon request.

**Cutting Oil Data:** A series of booklets containing valuable information about cutting oils and their uses for thread-cutting, broaching, and general cutting purposes will be sent free to any mechanical executive by D. A. Stuart & Co., 2727 South Troy St., Chicago, Illinois.

**Engineering and Manufacturing Services:** A complete engineering and manufacturing service for manufacturers who are not equipped to handle all of their own designing, experimental, or production work is described, with illustrations of the equipment available, in a bulletin that is issued by The Steel Products Engineering Co., Springfield, Ohio.

**Flexible Shaft Equipment:** The uses of the flexible shaft for drilling, grinding, and other operations is discussed in a booklet which also describes and illustrates the flexible shaft equipment made by N. A. Strand & Co., 5001 N. Lincoln St., Chicago, Ill.

**High-Speed Milling Principles and Practices:** A book that shows how the Rigidmill can be adapted to various kinds of usual and unusual milling operations, and which describes in detail the work that can be handled by this machine has been issued by the Sundstrand Machine Tool Co., Rockford, Ill. Copy free upon request.

**Quality Drilling Machines:** The high-grade drilling and tapping machines made by the Sundstrand Machine

**Precision Measuring Instruments:** The gages, micrometers, and other precision measuring instruments made by the Swedish Gage Co. of America, 7310 Woodward Ave., Detroit, Mich., are fully described in an interesting booklet that has been published by this firm. Copy free upon request.

**Snap, Plug, Ring, and Thread Gages:** The complete line of precision gages made by The Taft-Peirce Manufacturing Co., 32 Mechanic Ave., Woonsocket, R. I., is described in a folder which can be obtained, free, by addressing this company.

**Save Cutting Oil:** How cutting oil can be separated from chips and thus reclaimed by the use of a centrifugal chip "wringer," is told in a bulletin that is issued free by the Tolhurst Machine Works, Troy, N. Y.

**Chuck With Air:** How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomlinson Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

**A Simplified and Improved Drive Control for Machinery:** Two distinct types of plate clutches that have proved successful highly in the driving mechanism of machine tools are described and illustrated in a bulletin that will be sent free by the Twin Disc Clutch Company, Racine, Wis.

**Powerful, Easy-Acting Chain Hoists** of the most modern design are described and illustrated in a booklet that is issued by the Union Manufacturing Co., 296 Church St., New Britain, Conn. Copy free upon request.

**Multiple Drilling With a Single-Spindle Drill:** Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati.

**Electrically-Driven Portable Tools:** The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 24, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

**Van Norman "Duplex" Milling Machine:** A milling machine especially adapted for a wide range of operations on tools, dies, jigs, gages, and general utility purposes is described and illustrated in a booklet which has been issued by the Van Norman Machine Tool Co., 150-200 Wilbraham Ave., Springfield, Mass. Copy free upon request.

**"Wedge-Lock" Multiple Bit Tool Holder:** A new type of tool holder, in which the tool bit is held by the action of a wedge, is described in a bulletin which will be sent free upon request by the Wedge-Lock Tool Co., 549 W. Randolph St., Chicago, Ill.

**Shop Furniture:** A catalog describing and illustrating all kinds of shop furniture, including benches, vices, steel stands, foremen's desks, chip trucks, steel racks for bar stock, steel tote boxes, and other equipment will be sent free upon application to The Western Tool & Manufacturing Co., 1620 East Pleasant Street, Springfield, Ohio.

**Hardness-Testing With Accuracy and Speed:** The principles of testing for hardness by the use of the Rockwell Hardness Tester are discussed in a booklet which also shows a number of applications of this instrument, published by the Wilson-Macaula Co., Concord Ave. and 143rd St., New York, N. Y. Sent free upon request.

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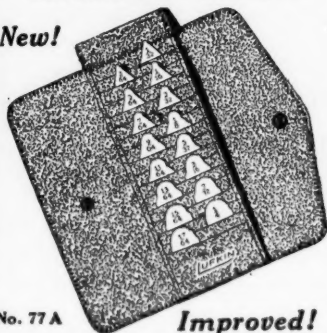
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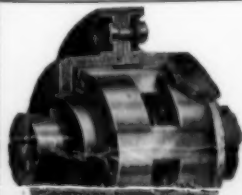
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